MARCH 1948

Public Works Magazine

IN THIS ISSUE:
Better Streets for Hartford
How to Use Scrapers
A Swimming Pool on Cost-Plus
Chicago's New Filter Plant

TO PRACTICAL MEN HUBER MEANS ROAD MACHINERY AT ITS BEST!

It is an easy matter for practical road men to spot "seasoned experience" in road machinery. It is reflected in the soundness of its design.....in the way it tackles a job.....in the engineered refinements that speak of a knowledge of road building and maintenance problems.

Huber Road Machinery reflects all this in full measure.....the husky 3-wheel automotive type Road Roller built in sizes from 3 to 12 tons....the variable weight Tandem Roller of maximum maneuverability from 3 to 12 tons.....the Maintainer for bulldozer, snowplow, broom, patch roller, etc.....each in its own way delivers top performance at low operating cost to save time and money on every road job.

Switch to Huber Road Machinery. It is the practical thing to do. See your nearest Huber dealer for a demonstration.

THE HUBER MFG. COMPANY • MARION, OHIO, U. S. A.

HUBER

3 Wheel • Tandem

ROAD ROLLERS *and* MAINTAINERS

Vol. 79 — PUBLIC WORKS — No. 3

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MARCH, 1948

Now! BIGGEST FORD TRUCKS EVER BUILT

NEW FORD BIG JOBS

GROSS TRAIN WEIGHT RATINGS UP TO 37,000 LBS.

G.V.W. RATINGS UP TO 21,500 LBS.

TRUCK BODY AND PAYLOAD RATINGS UP TO 14,200 LBS.

Plus! Hottest new truck line ever offered by the Leader in Trucks Built and Trucks in Use!

They're red-hot! Ford *Bonus** *Built* Trucks for '48 are the hottest trucks in Ford history! Over 139 new models for the widest job coverage ever! Three new engines, a Six and two V-8's! New Million Dollar cab! New BIG JOBS! Dozens of new features, plus the unparalleled know-how of the truck maker who has built more trucks than anyone else, and has more trucks in use today! For 30 consecutive years there have been more Ford Trucks in use than any other make! See your Ford Dealer today!

*BONUS: *"Something given in addition to what is usual or strictly due."—Webster*

BUILT AND WARRANTED FOR UP TO 37,000 LBS. GROSS

NEW HIGHER RATINGS!
Gross Train Weight up 48%
Gross Vehicle Weight up 42%
Truck Body and Payload up 39%.

Series	Gross Train Weight	Gross Vehicle Weight	Truck Body and Payload
F-7	32,500 lbs.	19,000 lbs.	12,500 lbs.
F-8	37,000 lbs.	21,500 lbs.	14,200 lbs.

145 HORSEPOWER V-8 TRUCK ENGINE!
45% more horsepower than "239" V-8! 337 cu. in. displacement. 255 lbs-ft. torque at 1800 r.p.m.

UP TO 10.00-20 TIRES!
Single front and dual rear. 9.00-20's available on the F-7 BIG JOB.

NATIONWIDE SERVICE!
Ford BIG JOBS are backed by 6400 service stations—more than are available for any other trucks in this capacity range.

Listen to the Ford Theater, Sunday afternoons, NBC Network. See your newspaper for time and station.

FORD 1948 *Bonus Built* TRUCKS 1958

BUILT STRONGER TO LAST LONGER

LIFE INSURANCE EXPERTS PROVE AND CERTIFY . . . FORD TRUCKS LAST UP TO 19.6% LONGER

When you need special information—consult the ENGINEERS' LIBRARY *on pages 77-80*

PUBLIC WORKS Magazine

Founded in 1896

Devoted to the interests of the engineers and technical officials of cities, counties and states

Vol. 79, No. 3

W. A. HARDENBERGH and A. PRESCOTT FOLWELL
Editors

MARCH, 1948, CONTENTS

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The Editor's Page

The Nation's Investment in Technical Knowledge

We have spoken many times of the necessity for safeguarding our supply of technical men. A broader consideration of all factors leads us to extend our previous statements. It is technical knowledge that must be safeguarded. It is not sufficent to limit our considerations to men with formal technical training. Any sound program must consider also the men who, while not registered or accredited engineers, are essential because of their "know-how" in construction, maintenance and operation of technical works. The professor might call these men "technicians." No matter what name we apply to them, they are as important as the engineer, whether in peace or in war.

During the recent war, such men had no draft status; they were taken from the construction job, the sewage treatment plant, the water works or the highway, and arbitrarily made into infantrymen, turret gunners, or able seamen. Despite the fact that the army needed all of these categories of skilled workers (and the Navy many of them) there was no plan to utilize their skills in the armed forces. Instead, unskilled or partly trained men had to be used for army and navy water and sewage plants, and allied work; and back at home, local governments had to use the same sort of skills.

It is too much to ask the army and the navy, in the midst of getting ready for an emergency, to come up with a sound solution to all these problems; but it isn't too much to ask that serious consideration be given to solving this problem during peacetime. It is a job in which the army, the National Resources Security Board and the civilian engineering organizations can and should work together.

The Editor Apologizes

Our governmental agencies send us a great deal of material, all neatly mimeographed, frequently on both sides of the sheets, this with the laudable intention, no doubt, of reducing the running expenses of the government. This material comes from many sources, both pertinent and non-pertinent to the field this magazine serves. Uncle Phil Fleming and his Federal Works Agency are perhaps our principal contributors, though several other Washington offices furnish exciting competition.

There should be much material of value to our readers in these "releases" (to use a public relations term that is quite in style right now). Judging from their scholarly tone, they should assay up to at least several dollars per ton. It is a matter of much regret to your editor that he is a slow reader and unfamiliar with many of the big words used. As a result he is unable to get through one "release" before several others reach his desk. This lack of digestion facilities—or, to put it in other words, absence of stomach for this profusion of "releases"—prevents our readers from receiving the beneficial, and often thrilling, data being "released" by their public servants. Hence our apology. We regret that our readers must look elsewhere for full presentation of such material. In the meantime, we shall endeavor to cover up our deficiencies by publishing articles of a relatively brief and to-the-point nature; we may even revert to our pre-war policy of publishing Timewasters. We can understand some of *them*.

Organizational and Pay Problems

Before the war the highway construction industry, says Dwight W. Winkelman of the Associated General Contractors, "represented an efficient factory for the production of highways, at the lowest possible cost per mile. The war shut down this factory and dispersed our organizations all over the world. Now, since the end of the war, we have been surprised and shocked at how long it has taken us to get that factory going again. We thought we could reconvert in six months or so and that we would be working with the same men as before the war and with the latest model shovels and tractors. This has not been the case. Many highway contractors have had to start from the ground up in building up their organizations and their equipment."

"One important corollary of advanced planning and an assured program (of construction) from year to year, would be a trend among state highway departments to build up their engineering forces and keep them fully staffed. The low pay scales and (resulting) shortages of highway engineers are very serious problems to-day and concern contractors as well as the highway departments, for work cannot go ahead as rapidly as it should if there are not sufficient engineers available to plan and supervise. State governments . . . should provide higher salaries for increased engineering staffs, commensurate with the volume of work and the responsibility."

Here are two problems on which PUBLIC WORKS has been continuously vocal: On-the-job training for our personnel, and adequate pay for engineers. By adequate pay we mean at least as much as other professional men in corresponding positions receive.

The Future of Temporary Housing

All of us have heard a lot about the dubious quality of this present-day housing, whether emergency housing, or the structures built to meet the immediate demand for homes. We have had a good many doubts about it ourselves; but the other day we saw a comment in an English journal to the effect that the "temporary" housing built in London after the great fire of 16-something (was it about 1665?) was still in use until destroyed by the German bombing attacks in 1942. So maybe our 1947-model temporary and emergency housing will be with us longer than we think. There are both good and bad implications in this, and you can take your choice between them.

...Le Roi announces the Model 52 Paving Breaker

...its new, easy-holding action packs a wallop that saves you money

Here's a new paving breaker that you must try. Our tests, and they've been tough, indicate that this machine reduces the cost of breaking concrete. The 52 is truly a champion — these features guarantee it:

● **A knock-out punch that puts "high costs" down for the count.** Le Roi's 52 breaker has a happy combination of bore, stroke, valving, and timing that produces its highly effective concrete-shattering blow.

● **Easy to handle.** The 52 weighs 80½ pounds. Overall length is only 29 inches, and handle width 15 inches — operators can move it around with less effort. Rubber hand grips, a new valve action, and an air-cushioned front end minimize vibration. A latch-type retainer makes steel-changing easy.

● **A bear for punishment.** Sturdy drop forgings are used throughout. The throttle valve has a replaceable bronze bushing. The slug-type piston is reversible, a feature that adds many hours of operation to its life. A generous oil reservoir and a new type of lubrication system helps maintain peak operating efficiency — *the 52 is the first breaker to introduce positive shank oiling to increase chuck-bushing life.* A generous bearing giving full support for the full length of the tappet stroke, maintains alignment, and eliminates tappet spalling. A swivel hose connection increases the life of the hose.

● **A miser when it comes to using air.** You can run Le Roi's Model 52 off any standard 60-foot compressor. The 52's new end-seating valve meters the air sparingly without weakening the force of blow — and it actually improves with use, assuring efficient dependability.

The frost will be out of the ground before long — so see your Le Roi distributor about delivery of Model 52's for your spring work.

Write us for literature.

SPECIFICATIONS

Weight, lbs.	80½
Length, inches	29
Width, inches	15
Standard Shank size, inches	1¼ x 6*

*1⅛" x 6" shank also available. Sheeting driver frontheads can be supplied for 2, 2½, and 3-inch piling. Spike driver frontheads are also obtainable.

LE ROI COMPANY

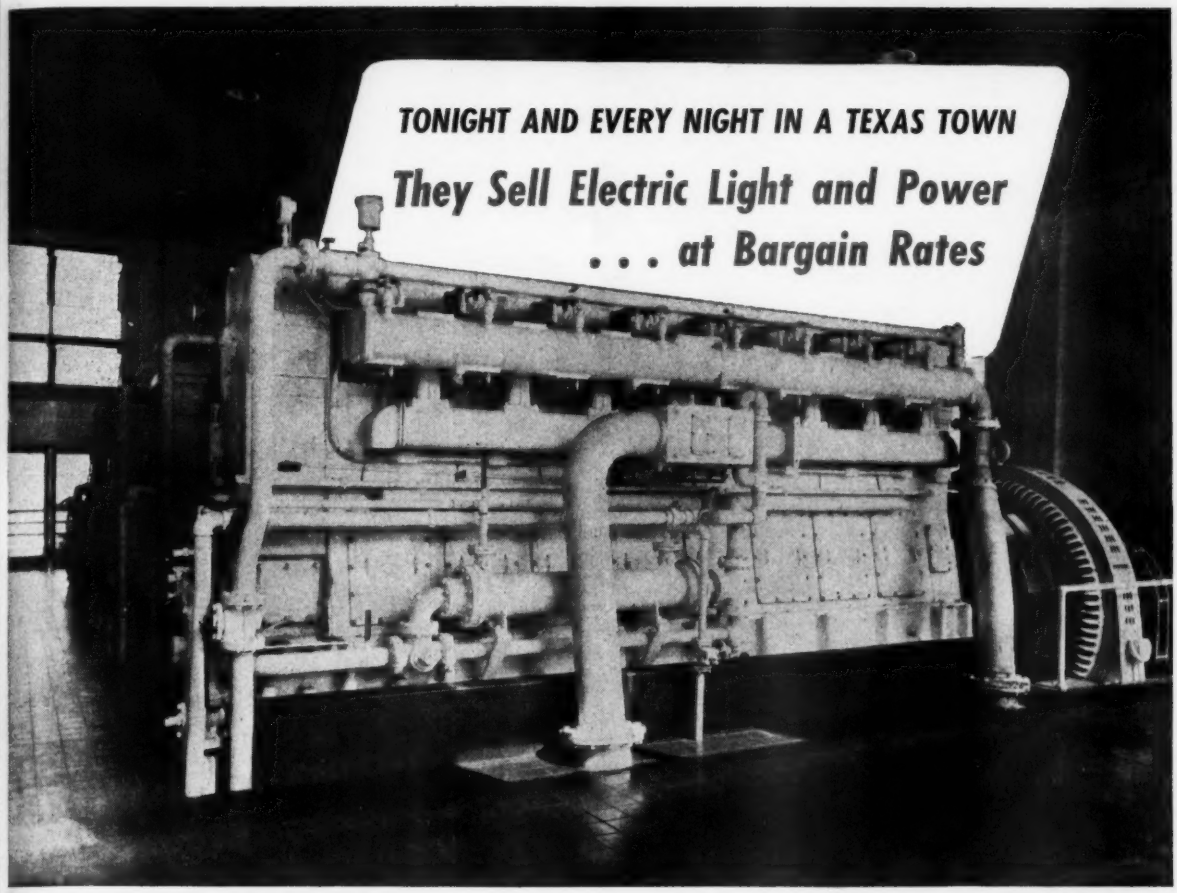
MILWAUKEE 14, WISCONSIN

NEW YORK • WASHINGTON • CLEVELAND • BIRMINGHAM
TULSA • BUTTE • SAN FRANCISCO

RD-18

Take a round out of pavement-breaking costs with LE ROI'S New 52

When you need special information—consult the ENGINEERS' LIBRARY on pages 77-80



TEN years ago, the folks in Robstown wanted a dependable source of power. They got it . . . with two 6 cylinder, 525 hp. and two 8 cylinder, 700 hp. Superior Diesel Engines.

Just six years after this plant was completed, power rates were reduced! In addition to bargain rates, this plant has provided a substantial net profit.

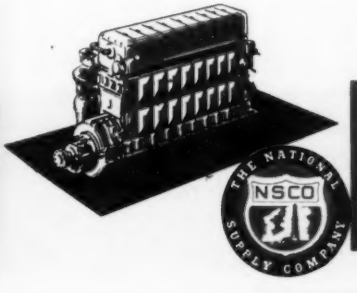
Many other communities throughout the country are benefiting by the dependability and economy provided by Superior Diesels. These big, husky engines are used for water supply systems, sewage disposal plants, airport lighting and for many other vital municipal services.

Superior Diesels are made in supercharged and non-supercharged models that range from 170 to 1440 horsepower. One of our field engineers will be glad to point out the advantages these engines have for your community.

PUSH-BUTTON DUAL FUEL

A Superior Feature

Superior is the first and only Diesel with push-button control that permits you to switch from oil to gas; or gas to oil instantly — with the flick of a finger.



SUPERIOR ENGINE DIVISION OF
THE NATIONAL SUPPLY COMPANY
Plant and General Sales Office: Springfield, Ohio

Superior DIESEL

Only Superior Diesel Engines Give You Superior Features

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Floods and their inevitable aftermath—the menace of epidemic water-borne disease—call for quick and effective action. Countless communities stricken by flood waters know how Mathieson's Sanitation HTH affords prompt chlorination of polluted water supplies—prevents the scourge of disease and makes possible early resumption of safe water service.

Flood threatened communities should maintain adequate stocks of Sanitation HTH to secure the protection its 70% available chlorine provides in meeting flood and other emergency conditions. Check your stock now—and write or wire for an additional supply of Sanitation HTH if required.

Sanitation HTH is available in cases of nine 5-lb. cans and in 100-lb. drums.

Mathieson
CHEMICALS

THE MATHIESON ALKALI WORKS (INC.)
60 East 42nd Street, New York 17, N.Y.

SANITATION HTH . . . LIQUID CHLORINE . . . PH-PLUS . . . FUSED ALKALI
CAUSTIC SODA . . . SODA ASH . . . BICARBONATE OF SODA
CHLORINE DIOXIDE . . . AMMONIA, ANHYDROUS & AQUA . . . DRY ICE
CARBONIC GAS . . . SODIUM CHLORITE PRODUCTS . . . SODIUM METHYLATE

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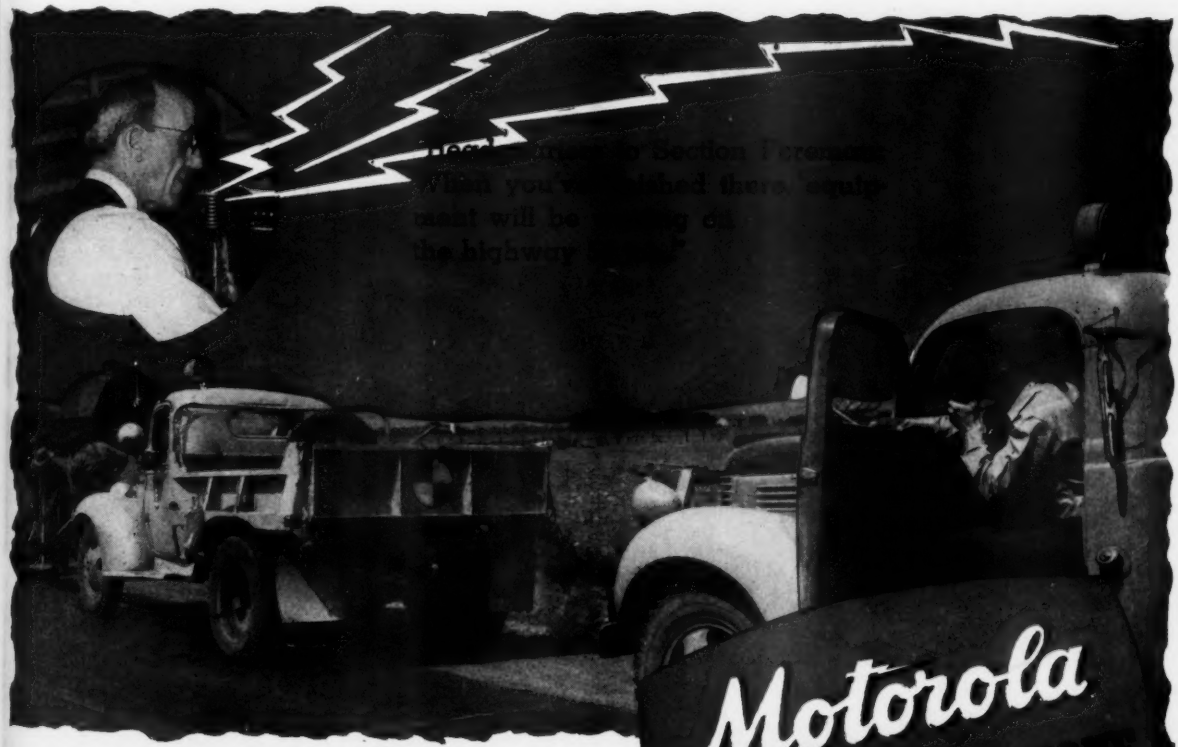

FAST TALK

saves money as it SPEEDS ROAD CONSTRUCTION AND MAINTENANCE

You cut down waste motion and "dead" mileage when your section foremen, supervisors and main office are in direct, instant contact with each other for fast action on every phase of your operation. Motorola Radiotelephone gives your main office constant control over every job and enables you to keep constantly informed of work progress, accidents or needed equipment. Motorola Radiotelephone speeds work within a single road crew when it is spread out over miles of highway. So much does Motorola Radiotelephone add to the efficiency of industrial operations that many users report that in savings alone it has paid for itself in one month of operation.

Motorola Radiotelephone has been proved dependable in thousands of installations. It is the four-to-one favorite of police departments across the country. You can prove to yourself the superiority of Motorola Radiotelephone by comparing it with any other communications equipment at any price.

GET THE COMPLETE COST-SAVING STORY. A Motorola Field Engineer will be glad to call to discuss your specific communications problem. No obligation. WRITE TODAY!

Motorola Guarantees Full Channel Utilization Through "Precision Selectivity"

"PRECISION SELECTIVITY" requires no reduction of channel width. Motorola *guarantees* utilization of the full channel width authorized by the Federal Communications Commission with consequent maximum noise reduction.

"PRECISION SELECTIVITY" in the receiver provides full insurance against interference to your signals from nearby central stations. Exact frequency stability with Motorola contherm "Precision" crystal results in better quieting and a higher signal-to-noise ratio. Tolerances throughout far exceed those required by the FCC.

"PRECISION SELECTIVITY" in the transmitter gives better frequency stability, allows full suppression of spurious output and permits full utilization of valuable channel space.

Remember — when you consider the installation of radiotelephone service —

ONLY Motorola has P.S.

ONLY MOTOROLA GUARANTEES FULL CHANNEL UTILIZATION

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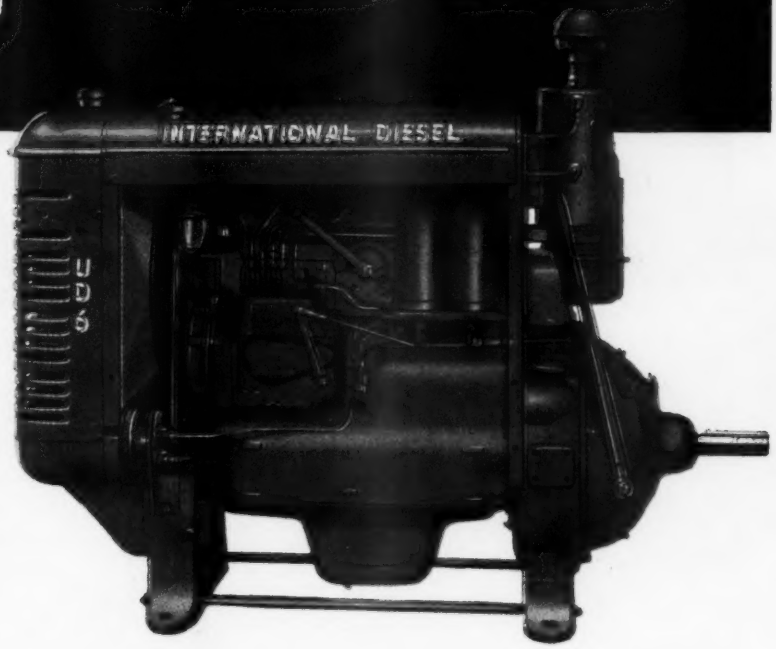
Power to Your Order



39 *Working* Horsepower

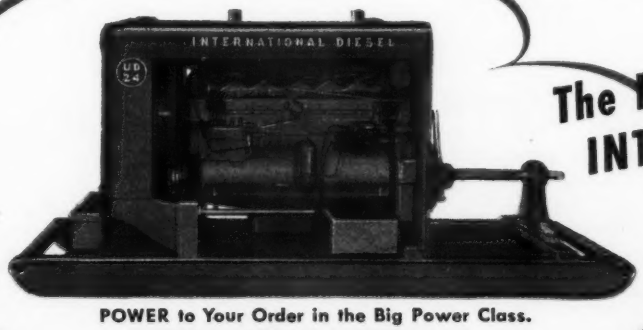
That's what this International UD-6 Diesel Power Unit delivers at 1500 r.p.m. A self-contained starting system permits hand cranking or use of an optional 12-volt electric starter for easy starting regardless of weather.

The UD-6 is a 4-cylinder, 4-cycle, valve-in-head engine with advanced design fuel injection, thermostatically controlled cooling, full pressure lubrication, sensitive variable-speed governor with torque control, renewable element oil filters, a large capacity oil-bath air cleaner and all the other typical International features of construction and design that make International engines superior for heavy-duty powering.

INTERNATIONAL Engines and Power Units are available in a range of sizes that makes delivery of *POWER to Your Order* a simple matter! Simply choose from the International line of *four* carburetor-type and *six* Diesel power units. That's the way to be sure of getting the full rated horsepower, the matchless operating economy, the dependability and long service life which Internationals deliver. The horsepower range is from 22 to 55 H. P. for carburetor models and 39 to 180 H. P. for the Diesels.

Let your International Industrial Distributor help you select the power and equipment you need. He can show you why it's *good business* to standardize on Internationals.

Industrial Power Division
INTERNATIONAL HARVESTER COMPANY
180 North Michigan Avenue • Chicago 1, Illinois



POWER to Your Order in the Big Power Class.
Delivers 180 H.P. at 1375 r.p.m.

The New 180-Horsepower INTERNATIONAL DIESEL

The UD-24

This giant of power is a complete, closed-type, independent, portable power plant that starts at the touch of a button. Its full-Diesel engine cannot be matched in its power class for economical and dependable performance. Ask your International Industrial Distributor for the complete story on this new International Diesel.

INTERNATIONAL *POWER*

CRAWLER AND WHEEL TRACTORS • DIESEL ENGINES • POWER UNITS

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WRAP UP YOUR MAINTENANCE PROBLEMS WITH THIS EQUIPMENT PACKAGE . . .

Allis-Chalmers HD-5 Tractor with Tracto-Shovel* and Model A-D Motor Grader

*All-'Round, All-Year Machine — Besides 1 cu. yd. standard bucket, interchangeable attachments for Tracto-Shovel include 3/4 cu. yd. narrow bucket and bucket teeth, 2 cu. yd. snow loader bucket, bulldozer blade and V-type snowplow. Outfit may be used with Gar Wood 2-wheel scraper, too, using shovel hydraulic system.

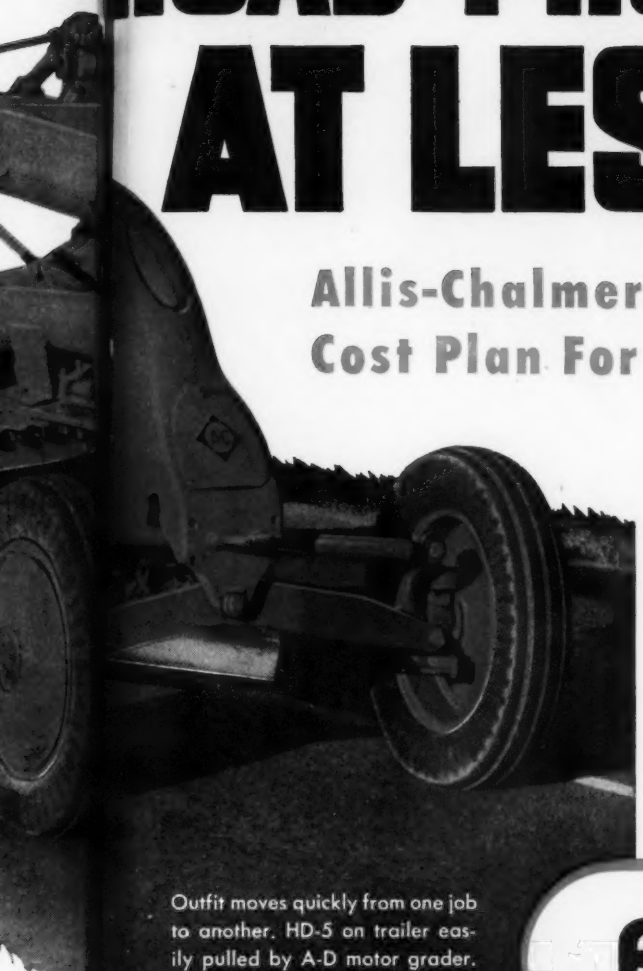
SOME OF THE JOBS YOU CAN DO WITH THIS COMBINATION—*working together or separately:*

- Clean and shape-up ditches
- Cut and smooth backslopes
- Handle regular maintenance
- Widen and reshape roads
- Make driveways
- Build berms
- Scarify roads
- Backfill pipe, culverts, bridges
- Take out cuts
- Make fills
- Do all bulldozing
- Plow, move and load snow
- Skid trees
- Load rocks and stumps
- Dig and load dirt or other material
- Mix black-top
- Do crane work
- Handle hauling or pulling

A TYPICAL JOB TO BE DONE—straightening out road, cutting down hill and making ditches for proper drainage.

ROAD PROTECTION AT LESS COST

Allis-Chalmers Brings You A New, Low Cost Plan For Road And Street Upkeep



Outfit moves quickly from one job to another. HD-5 on trailer easily pulled by A-D motor grader.

No need to make a major investment in equipment to handle various jobs. Any maintenance work . . . and much of your construction . . . is quickly, efficiently done with this versatile combination — AT BIG SAVINGS. There is only a nominal original cost with correspondingly low upkeep . . . but the work accomplished is considerably widened. Take a look at the list of jobs you can do — it's endless! Whatever your maintenance problem, this equipment package will wrap it up at the lowest cost.

ALLIS-CHALMERS
TRACTOR DIVISION • MILWAUKEE 1, U. S. A.

E DONE—B NEARING COMPLETION — all
d, cutti ding handled with HD-5 and Tracto-
ditches f vel and the Model A-D Motor
ader. Surplus dirt loaded into trucks
h shovel . . . shaping and finishing
ne with grader.

CLEANING-UP DITCHES—here the road surface is kept intact, only ditches and slopes made. Accomplished by pulling up dirt with A-D motor grader and loading surplus into trucks with HD-5 and shovel.

CUTTING THE BACKSLOPES — sloping, ditching, rough and fine grading . . . all these jobs are quickly, accurately handled with the greater earth-moving capacity of the Model A-D motor grader. Its extra traction and power make it the ideal machine, too, for scarifying and plowing snow.

When you need special information—consult the ENGINEERS' LIBRARY on pages 77-80

Look to the LEADER FOR LOW-COST POWER

As your municipality prepares to complete war-delayed plans for modernizing sewage treatment, consider the advantages Worthington offers you.

In providing 60 heavy-duty gas engines totaling over 17,000 hp to 30 communities between 1934 and 1941, Worthington kept in step with all the developments in modern sewage treatment plants. While its 500 hp installed in 1934 was growing to 7200 hp installed in 1941, Worthington not only advanced in design leadership but also built up invaluable experience in fitting the right engine to specific conditions.

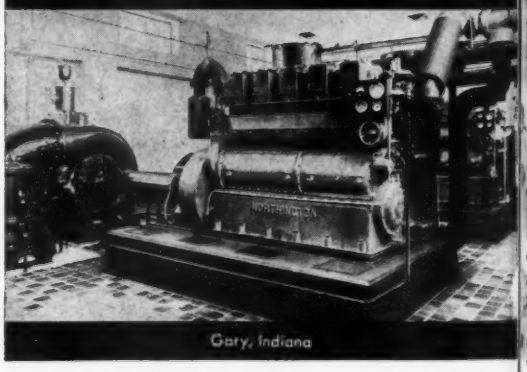
Now, at the beginning of the "new era" in sewage treatment development, Worthington offers a complete line of both spark ignition gas engines and dual fuel Diesel engines in sizes ranging from 225 hp to 1645 hp in single units.

That Worthington leads today, as in the past, is evidenced by a recent contract to supply the City of Boston with 5 engines totaling approximately 3000 hp, in both types of engines. For further proof that *there's more worth in Worthington*, write for literature. *Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.*

Tallman's Island, New York City

Sioux Falls, South Dakota

Greensboro, North Carolina



Gary, Indiana

WORTHINGTON

E7-7

YOUR PARTNER IN POWER PROGRESS

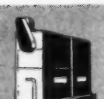
Diesel engines, 150 to 3,520 hp . . . gas engines, 175 to 3,290 hp . . . dual fuel Diesel engines, 225 to 3,290 hp.

WORTHINGTON-BUILT AUXILIARIES

Air King Compressors

Oil Transfer Pumps

Cooling Water Circulating Pumps



Evaporative Type Engine Water Cooler

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PUBLIC WORKS MAGAZINE . . . March, 1948

VOL. 79. NO. 3

BETTER RIDING STREETS AT LOWER COST

ROYAL W. THOMPSON
Superintendent of Streets

Using bituminous concrete and mechanical equipment gives smoother surfaces and lowers cost. How to fill cracks.

IN 1945 when I first came with the City of Hartford (Conn.), as Superintendent of Streets, the conditions regarding the resurfacing of so-called improved streets were as follows:

The improved street system in Hartford consisted of a 3-inch sheet asphalt pavement over a rigid concrete base. This system consisted of some 80 to 100 miles of our 200 miles of streets in the city. The remainder was, in the majority, a waterbound macadam type.

We have a very heavy underlaying clay soil and an extremely dense traffic movement into, out of and within the city itself. It is very surprising, but many of our minor secondary arteries constructed of waterbound macadam pavement are carrying anywhere from 3,500 to 7,000 cars a day, so the density of the travel in our downtown section and the main entrances and exits to the city itself can be realized.

Barber-Greene paver laying hot-mix in Hartford.

The Paving Situation

In 1945 there was only one source of sheet asphalt available to the city. This was from a plant located within the city limits and operated by a contractor who had also been performing all of the contract paving work, for the city of Hartford since 1916. The plant produced excellent sheet asphalt pavement from a native sheet asphalt sand which is available in great quantities a very few miles from the center of the city, and the paving work itself was excellent. The contractor was cooperative and did his best to give Hartford a very fine, high type pavement. The contractor also operated, within 8 miles of Hartford, his own trap rock quarry, producing a very high type stone and also a ready mixed concrete plant located within city limits which produced all of the concrete for base. This situation sounds ideal on the surface, but the competitive spirit of bidding and the competitive pride in a contractor's work when compared with that of other contractors was absent, a condition which is not healthy for the contractor or the city.

Improvements Through Change

The existing situation was not inducive to private capital to come in and erect a complete sheet asphalt plant, set up sources of supply and compete in city of Harford paving work. Neither did we feel that the city of Hartford should construct and maintain its own sheet asphalt plant to take care of the quantity of work that would be programmed over the next few years. With labor, and particularly municipal labor, what it is, the addition of employees to operate an asphalt plant meant that you had to carry them on the payroll for 12 months of the year thereby materially adding to the tonnage cost of material produced by the plant.

We made an extensive survey of the area within 10 to 12 miles of Hartford to find alternate available materials and possibly plants. We found one plant that was producing cold mix material, but could produce a hot mix bituminous concrete in medium quantities. We found that more than one quarry was able to meet a specification for a dense graded bituminous concrete. We then tried to standardize our mix and finally adopted a specification very close to the Connecticut State Highway Department specification for dense graded bituminous concrete. Our top surface uses a top size aggregate of 3/8" trap rock and 85-100 asphalt in the amount of about 6 per cent.

Tests and comparison in other localities where dense graded bituminous concrete had been used extensively proved to us that the service and durability of the bituminous concrete was at least comparable to and possibly

better than that of sheet asphalt. We also found that we would be able to lay the material by mechanical pavers rather than hand raking that had been used 100% in the past. It is most difficult to develop a good hand raker and the quality and evenness of the surface during the last few years that sheet asphalt was used was not anywhere near that of previous years.

During 1946 we advertised for bids on sheet asphalt and bituminous concrete as an alternate. During the year both types of pavement were laid. There were three bidders on all jobs and there were three different contractors that actually performed work in Hartford.

During 1945 the budget which had been adopted prior to my coming to the city called for an expediture of $90,000 for patching of pavement only. This item in the last two years we have absolutely eliminated and such patching as is carried out is done by Street Department forces on our regular payroll.

Resurfacing and Crack Filling

We have also found that 2 inches of bituminous concrete can be laid over an old sheet asphalt pavement, thereby improving the profile and contour. This is particularly true of the many miles of streets from which the street car rails had been removed and the street itself not entirely repaved.

In order to eliminate the transfer of existing cracks and breaks in the sheet asphalt, to the surface of the new bituminius concrete, we have adopted the following procedure. The year before we plan to lay 2 inches of bituminous concrete, or early in the season of the same year, we apply about 0.2 gallon of 120-150 penetration asphalt at 375°, or over, to the old pavement. This is covered at once with about 25 lbs. of premixed concrete sand. (Premixed in a pug mill with about 2 per cent by weight of MC 2). Sand temperature when applied is about 225°. Traffic is sent through at once and the heat and kneading action of the pneumatic tire works the material into all cracks and breaks forming an excellent base for the raw material. If any fattiness is noted, an additional application of ⅜ inch trap rock is applied. This material contains considerable quantities of No. 80 and No. 200 mesh material to insure against any shoving.

Three New Pavers Purchased

As a result of the interest in the bidding, there have been three mechanical pavers purchased by contractors in the Hartford area, and all the work for the 1947 season was performed by mechanical means resulting in a much finer riding pavement. A complete additional privately owned hot mix plant will be in operation for the spring of 1948—another source of supply.

During this season we scheduled 3.34 miles of paving at an estimated cost of $174,664. Due to the competitive spirit of the contractors, our estimates ran very high and we were actually able to pave 4.56 miles of pavement, that is, about 1.25 miles more than our program, for a total cost of $158,750, or approximately $15,914 less.

Unit Paving Costs

The overall unit cost of our paving program this year, which includes those streets from which the old asphalt pavement was removed, the concrete base repaired, 3 inches of bituminous concrete relaid in two courses; those streets in which we covered the old asphalt paving with 2 inches of bituminous concrete; concrete pavement that was covered with 2 inches of bituminous concrete; and all other types, was $1.23 a square yard. This includes not only the pavement but base repair, etc. This figure of $1.23 which includes all work in connection with paving, compares with figures in the past that include only the cost of removing the old pavement and resurfacing but not the cost of any additional base repair or concrete as follows:

1944	$1.55 a sq. yd.
1940	$1.40 a sq. yd.
1935	$1.45 a sq. yd.
1926	$2.25 a sq. yd. (Patching)

The reaction of the public has been excellent. They exclaim over the evenness and excellent ridability of the pavement installed with mechanical pavers. The merchants are overjoyed at the speed with which the job progresses when they see the paver going by their store windows rather than the old hand raking method.

On our final rolling of the bituminous concrete, we have been rolling in armor flex markers at all crosswalks, stops, center and traffic lines where required. The final result is very pleasing.

I might add that we used approximately 17,000 tons of bituminous concrete on our operations this year and absolutely no sheet asphalt.

Creosoted Pine Alabama County Bridge

A 14-span creosoted timber highway bridge was recently completed by Dale County, Alabama, on one of the important county roads making a junction with system route 27 some 10 miles east of Ozark, the county seat.

This bridge, which is located 4 miles south of the junction, is a timber trestle of conventional design, and has a 15-ft. roadway. All timber is southern pine pressure treated with creosote in accordance with standard specifications, with the exception of the handrails, which are untreated and painted white.

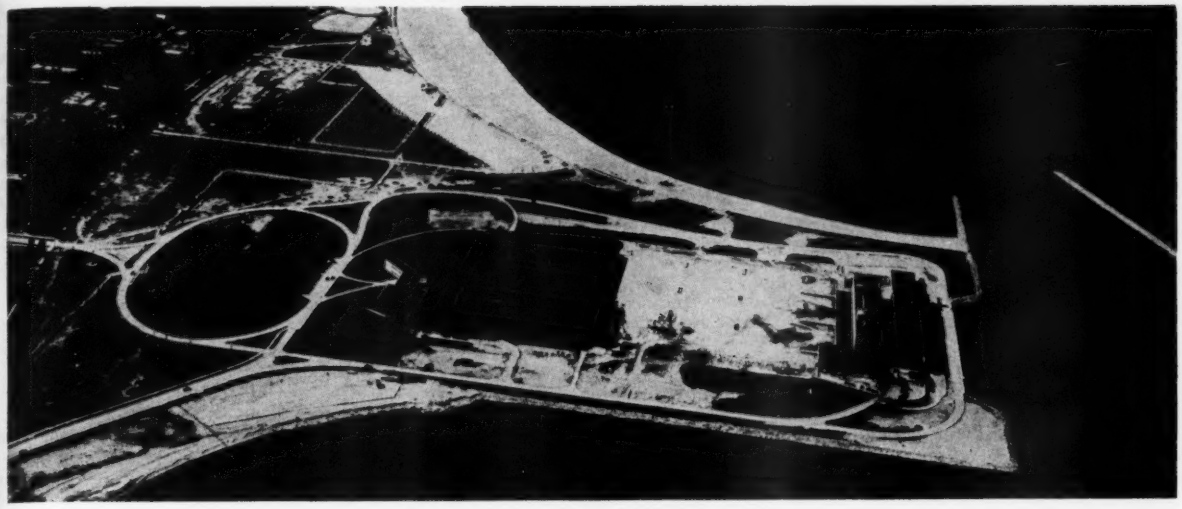
Pile bents are on 15-ft. centers and contain four piles each, capped with 10x10-in. timbers and stiffened by 3x8-in. sway braces. The decking is 3x10-in. plank laid flat and supported on 4x10-in. stringers on 17-in. centers.

The handrail is of the low type with a single longitudinal member near the top. Supporting posts are 4x6 in. in size and spaced 7½ ft. on centers. The light 4x6-in. curb is supported on scupper blocks of the same size to permit ready drainage.

Highway bridges for secondary roads are usually required to carry moderately heavy farm equipment and this is frequently the basis for design load, which in this case was for a 10-ton tractor.

Frank O. Deese is county judge having general supervision over the county roadway system. J. L. Baldwin is district supervisor. H. C. Jordan, contractor, prepared the design and carried out all construction work.—*Text and cut courtesy Wood Preserving News.*

This 14-span county bridge in Alabama was built of creosoted timber.



Aerial view of South District Filtration Plant.

Chicago's NEW FILTRATION PLANT

This new plant, serving 1½ million people, is designed to treat up to 600 mgd.; details of design and of plant layout; laboratory and other controls.

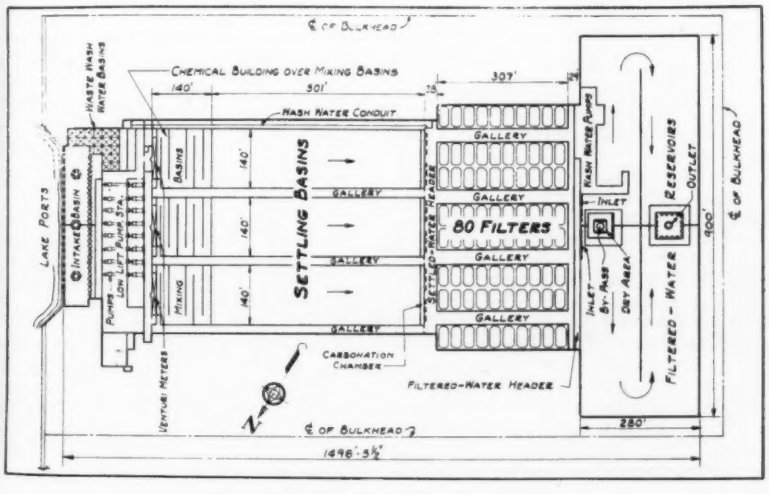
NOW nearly completed, Chicago's new $24,000,000 South District Filtration Plant, has been filtering all of the water for the District since last May; it was first placed in partial operation in October, 1945, but filtration was not started until early in 1947. Based on the customary rate of 2 gals. per minute per sq. ft. of filter surface, the filtering capacity of the plant is 320 mgd. However, the filters are designed to operate at a 4-gal. rate, and the other parts of the plant are designed accordingly, giving a maximum capacity of 600 mgd. Pumpage for 1946 for the area served averaged 339 mgd., and on several summer days exceeded a 600 mgd. rate for short periods.

The city area served by the new plant is approximately 112 sq. miles, or 53% of the area of Chicago. The suburban area served is about 50 sq. miles. The city population is about 1,400,000; the suburban population about 110,000.

There are two raw water intakes. Most of the water is obtained from the Dunne crib, 3.2 miles out in the lake; but during periods of high demand, some water is taken in at the plant intake.

The plant is located in Lake Michigan, off Rainbow Park, where solid rock is only 18 to 30 ft. below lake level, thus affording a good foundation.

The location involved much filling in around the plant, and the construction of a dam and breakwater. The depth to solid rock influenced the design of the plant in that it was found cheaper to construct 2-story mixing and settling basins and to locate part of the filtered water storage underneath the filters. New tunnels also had to be constructed, mainly to connect with existing lines from the lake cribs.



Layout of South District water filtration plant.

Intake and Low-Lift Pumping

The two intake basins are each 190 ft. long and 60 ft. wide, with seventeen 6′ by 8′ lake intake ports in each basin. The bottom of the basins are 24 ft. below lake level. There are 33 screens located in the intake basins, each 7′3″ by 14′, including frame. These have a total area of 3000 sq. ft. Between the screens and the pump suctions is a wall with eight 8′ by 8′ gates, so arranged that water can be supplied to all pumps from either or both basins.

The low-lift pumping station, with

a pump room 60 by 300 ft., is designed for nine pumps with a total capacity of 840 mgd. Initially eight horizontal motor-driven pumps have been installed, four with a capacity of 120 mgd. each and four with a capacity of 60 mgd. each. Suctions of the larger pumps are 54″ and discharges 48″; and of the smaller pumps 42″ and 36″. Cone valves are located in each pump discharge line, and each discharge is equipped with a venturi meter. The electrical station, 60 ft. by 140 ft. adjoins the pump room. A boiler room for heat and emergency equipment operation is located beneath the electrical station.

Chemical Application, Mixing and Settling

From the pumps, the water passes into three mixing and settling basins, thence to a common settled-water header and to the four settled-water laterals that serve the filters. The rate of flow to each mixing basin is measured by a 60″ by 45″ venturi meter, with indicating dials in the low-lift pumping station, the chemical building and the control room. After passage through the meters, the water flows through chemical rapid-mix application conduits and baffled channels to the main flocculating basins.

The three mixing basins are divided into an upper and a lower section, and are of the "around-the-end" type, with the channels equipped with mechanical agitation. At an operating rate of 339 mgd. the time of flow through the mixing basins is 48 minutes. Discharge is through slots in the end walls to the two-story settling basins. The mechanical mixing devices are geared to produce four peripheral paddle speeds—0.7, 1.0, 1.2 and 1.5 feet per second to obtain most effective flocculation. The forward movement of the water is parallel to the shaft of the mixer and, at average operation, is at the rate of 15 ft. per minute.

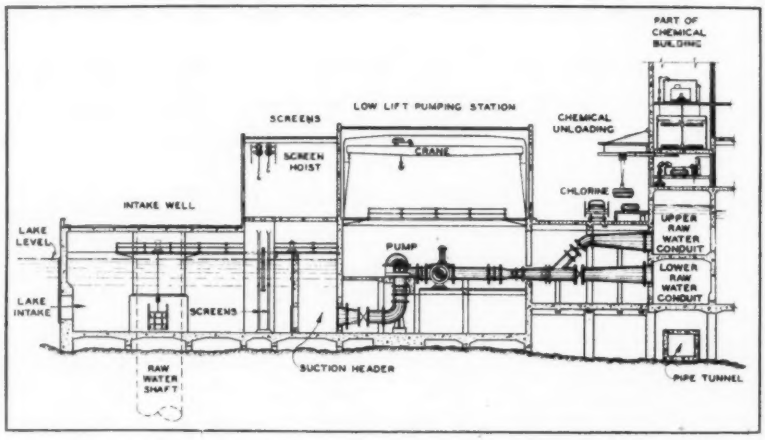
The three two-story settling basins are each 138 ft. wide and 500 ft. long, including the carbonation chamber at the outlet end. At the 339-mgd. rate of operation, detention time is 3.5 hours. The water from the upper and lower sections of each basin joins at the outlet and passes under a common baffle into a chamber provided for recarbonation, if this treatment is adopted. Thence it passes through six 5′ by 5′ gates in each basin into the settled water header.

Sludge Removal and Disposal

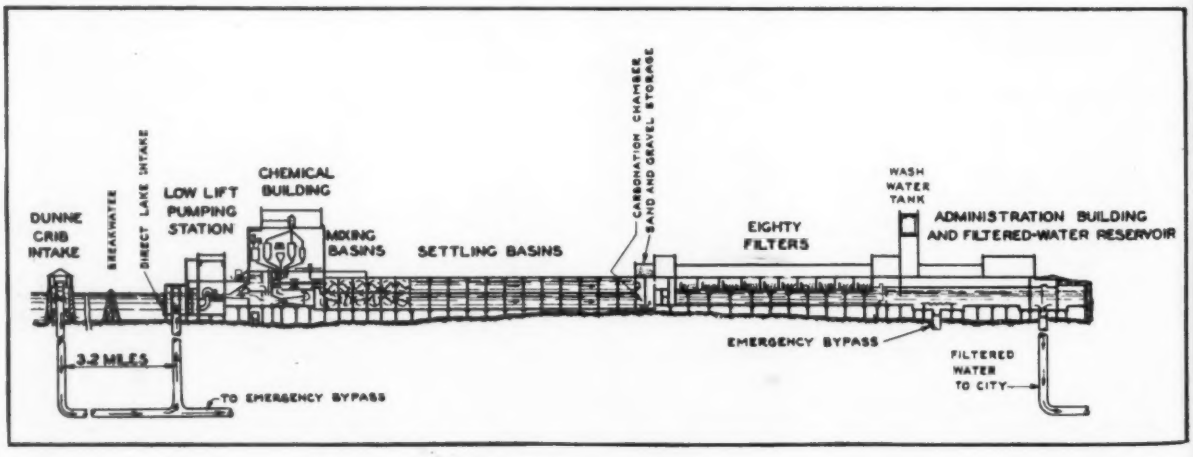
The first 160 ft. of each two-story settling basin is provided with mechanism for the continuous removal of sludge. This is of the endless chain type, with flights at 10-ft. intervals. The sludge is moved across the floor of the upper level, drops down to the lower level, and is then moved in an opposite direction (to that of the upper level) across the lower floor to a sludge channel. The basins will be dewatered periodically and the floors flushed to remove accumulated sediment. Both the sludge and the material removed by flushing will be discharged into the lake through two pipe lines 3,600 ft. long. The filter wash water is passed through settling tanks, the supernatant returned to the plant intake, and the sediment pumped into the lake. For each settling basin gallery, one 850-gpm. sludge pump is provided, and an additional pump will be added later. At the sludge well are located five sludge pumps, ranging in capacity from 350 gpm. to 2,250 gpm. These will provide for sludge return to the mixing basins, if desired, and for discharge of sludge into the lake.

Chemical Building and Equipment

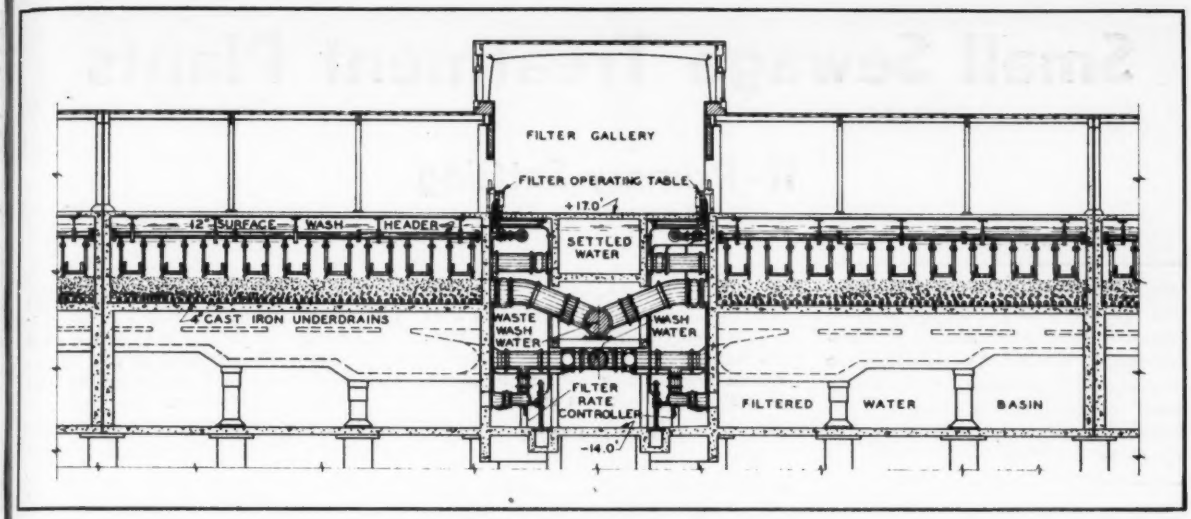
The chemical building is 60 ft. wide, 360 ft. long and 96.5 ft. high above lake level. It provides storage space for all chemicals except sulfuric acid, and also houses the chemical handling and feed equipment. For unloading dry chemicals, such as aluminum sulfate and lime, three pneumatic unloading units are provided, each with a capacity of 10 tons per hour. From the conveyors, discharge is into horizontal screw conveyors for distribution to 31 reinforced concrete storage bins. Of these, 11 are for aluminum sulfate, 9 for lime, 3 for ammonium sulfate, and 8 are spares for lime or aluminum sulfate. The bins for lime and aluminum sulfate hold 45 to 50 tons each. The chemicals discharge from the storage bins either directly into the dry feed machines or into a distributing screw conveyor for hop-



Intake well, screens, low-lift pumps and chemical unloading.



Section through plant and flow diagram.



Typical section through the filters and filter gallery.

pers not directly under a bin. Each weigh-hopper connects to a dry-feed machine, of which 30 have been installed. Nine of these are for feeding aluminum sulfate, six for lime, six for ammonium sulfate and nine for activated carbon.

Liquid chemicals, such as sodium silicate and sulfuric acid, are received in bulk and pumped into storage tanks. Thence they are pumped to the preparation tanks on the upper floors of the building for discharge to the feeders.

Chlorine is received in 1-ton containers on multiple unit tank cars. Storage is on a platform along the chemical building whence the cylinders are hoisted as needed and carried by monorail to the scale room, where the cylinders are placed in tanks on the weighing units. Connections are provided to caustic soda tanks so that a leaky chlorine cylinder can be submerged quickly; but the principal purpose of the tank-mounting on the scales is to warm the cylinders for more rapid evaporation of the chlorine.

Twelve chlorinators have been installed. Four of these have a capacity of 2,500 pounds each in 24 hours; the other seven are of 750-lb capacity. The water is chlorinated in advance of the addition of other chemicals, and additional chlorine is added as the water leaves the plant if the residual falls below a predetermined figure. Very long chlorine feed lines are used.

Filters and Reservoirs

There are 80 filters of the rapid type with perforated pipe underdrains and concrete cast-in-place wash water troughs. Each filter is 25.8 ft. by 53.9 ft., with a sand area of 1,389 sq. ft., and a nominal daily capacity of 4 mg.; but each filter is designed to operate at a 10-mgd. rate, if desired. Filter underdrains are 4-inch cast iron perforated pipe, spaced 12 ins., with 7/16-in. holes 6 ins. apart and facing downward. Supporting the filter sand is a gravel layer 21.5 ins. deep, placed in six graded layers from 1½ to 3½-inch gravel at the bottom to 1/12 to 1/8-inch material at the top. The sand is 24.5 ins. deep, with an effective size between 0.62 and 0.70 mm.

Each filter has a specially designed rate controller of 8 mgd. capacity, employing a venturi tube and a hydraulically operated butterfly valve. A pneumatic telemetering system is used for operating the rate-of-flow and loss-of-head gauges located on the operating tables. The pneumatic system is also used for operating the summation-of-flow meters and the master control rate setter for the filters. Filter operating tables are of sheet metal and marble, of attractive design. Five lever handles, connected to 4-way valves, operate the five hydraulic filter valves for each filter.

There are four 7,000-gpm. wash-water pumps; for ordinary purposes of filter washing, one is sufficient, but these pumps, in addition to washing, pump into the wash water tank, and provide process water for the plant, including chemical solutions, flushing, and sprinkling.

Each filter is equipped with a surface wash of the fixed jet type. A 12-in. header along the sidewall of each filter has eighteen 3-inch laterals with 1-inch downpipes to the jets located about 3 ft. 3 ins. apart along the pipe. The jets are formed by five ¼-inch holes, four of which project the water at a 30° angle, while the other points straight downward. Each filter has 9 reinforced concrete wash water troughs with flat and level undersides, and without appreciable slope; however, the width and depth are sufficient to carry off the wash water.

The eight filtered water basins are 53.3 ft. by 320.2 ft., with a combined capacity of 15 mg. From these, the water flows to two main filtered water reservoirs, each 280 by 450 ft., with a total capacity of 32 mg. From these, the water passes into the distribution system.

The filter building is 365 ft. wide and 575 ft. long. The 80 operating tables are located in four filter galleries, ten tables on each side of each gallery. The wash-water tank holds 300,000 gals., is housed in a tower 89 ft. above lake level, and stores water for washing filters and for plant process water.

Control Station and Laboratories

The control station consists of a control room and a control laboratory. The control room is equpiped with 9 water level gauges, 7 residual chlorine recorders, 4 pH recorders, 5 integrating and recording flow meters, 1 water pressure gauge, wind direction and velocity meters and 2 temperature recorders. The control laboratory is equipped for conducting the water tests necessary to operate the plant, and is designed to keep the chemical control engineer informed of the changes in the water resulting from chemical treatment. The laboratory has a wall table 44 ft. long, a center table 16 ft. long, fume hood, storage cabinet, refrigerator and other equipment.

The laboratories occupy the two upper stories of a building 165 ft. long and 42 ft. wide. The chemical laboratory is 40 by 148 ft. In addition to 218 ft. of wall tables, 90 ft. of center tables and 43 ft. of fume hoods, an electron microscope is included. The bacteriological laboratory occupies the same space as the chemical laboratory, but is one floor above.

The exterior walls of the buildings are of Indiana oolithic limestone. The interior of the low-lift pumping station is of terra cotta in marine shades of green with contrasting buff. The chemical building is finished in buff glazed tile with exposed concrete. The filter building has terra cotta walls in aqua blue shades. In the administration building, finishing materials, as plaster and marble, are used extensively. The whole plant is extensively landscaped, the basins and reservoirs being covered with earth and planted.

Small Sewage Treatment Plants

II—Primary Settling

This series began in the February issue, and the first article discussed general factors in small plant design. This and succeeding articles are intended to help solve the problems of the 9,058 small communities reported by the Public Health Service to be in need of sewerage facilities.

REQUIREMENTS for detention as a basis for primary tank design have been tabulated for 20 states. Some states do not have set regulations, but prefer to consider each sewage treatment plant individually. In some other states, regulations are now under revision. Of the 20 states listed, 13 require or permit a detention period of 2 hours for primary treatment, except that 4 of them allow a shorter period, 1 or 1½ hours, for settling preceding treatment by activated sludge. Two states require 2½ hours primary detention; the others are indefinite, as 2 to 3 hours; or 2 to 4 hours.

For the purpose of this article, a detention period of 2 hours, based on the entire flow occurring in 16 hours, will be used for small plant design. This is good practice in small plants and does not normally add greatly to the cost. However, the State Sanitary Engineer should always be consulted to insure that state requirements are met.

Size of the Tank

With a detention period of 2 hours., based on the entire, flow occurring in 16 hrs. (equivalent to 3 hrs. detention on a 24-hr. basis) a tank capacity of 167 cu. ft. is required for each 10,000 gals. of flow. Assuming a flow of 100 gallons per person per day, and a design population of 1,500, the expected volume of flow would be 150,000 gals. per day, and the tank capacity required would be 2,500 cu. ft. By reference to Table 1, this would require a circular tank 22 ft. in diameter and a little more than 6½ ft. deep; or a tank 25 ft. in diameter and 6 ft. deep would provide a little excess capacity. Table 2 gives the same data for rectangular tanks. A 10 x 40 ft. rectangular tank 6½ ft. deep would be suitable.

Table 1 does not make any allowance for bottom slopes and is therefore conservative. A bottom slope of 1 inch per foot on a 20-ft circular tank adds about 86 cu. ft. to the capacities shown for sidewall depths. In rectangular tanks, the bottom is sloped toward the sludge hopper and if the depths shown are assumed as the average, no correction is necessary.

Table 1.- Capacity of Circular Settling Tanks in Cu. Ft.
(No allowance for capacity due to bottom slopes)

Depth	6'	6½'	7'	7½'
Diameter				
15 ft.	1060	1148	1236	1324
16 ft.	1206	1307	1408	1509
18 ft.	1527	1654	1781	1908
20 ft.	1885	2042	2199	2356
22 ft.	2280	2470	2660	2850
25 ft.	2945	3185	3430	3675
28 ft.	3696	4004	4312	4620
30 ft.	4241	4595	4949	5302

Table 2.- Capacity of Rectangular Settling Tanks in Cu. Ft.

Depth	6'	6½'	7'	7½'
Width & Length				
6 x 20.	720	780	840	900
6 x 25.	900	975	1050	1125
8 x 20.	960	1040	1120	1200
8 x 25.	1200	1300	1400	1500
8 x 30.	1440	1560	1680	1800
10 x 30.	1800	1950	2100	2250
10 x 40.	2400	2600	2800	3000
12 x 40.	2880	3120	3360	3600
12 x 60.	4320	4680	5040	5400

Fig. 1 shows a 26-ft. diameter clarifier furnished by Hardinge Co. for a high-rate filter installation. M. C. Fleming says: "We also supplied a 26-ft. diameter final clarifier for the same project. As a matter of fact, we have supplied our circular clarifiers down to 16 ft. in diameter for use in sewage treatment plants. It is my opinion that mechanical sludge collecting and skimming equipment is justified in tanks as small as 20-ft. diameter or even less, as such tanks use only a ¼ h.p. motor and can be operated continuously so that the scum and floating material is removed from the surface of the tank as soon as it floats. . . . It would not be unreasonable to say that if such a unit were given proper lubrication once a week, it could probably be run continuously for 20 years without any repairs whatsoever." Hardinge also furnishes mechanism for small rectangular tanks, which can be supplied also with scum removal equipment.

Some Small Installations

The Chain Belt Co. Type M1, rectangular clarifier, shown in Fig. 2, is made in small plant sizes. The installation in the New Richland, Minn., trickling filter plant is 6'6" wide, 32'3" long and 5'9" deep. The installation in the Greendale, Wis., activated sludge plant, consists of two units, each 10'0" wide, 35'0" long and 8'3" deep. One of the smallest installations is that at the Hales Corners trickling filter plant, shown in last month's issue, where there is one primary tank 6'0" wide and one 8'0" wide; both are 20 ft. long and 8'1½" deep. The secondary settling tank on this job is 10'0" x 22'6" x 7'1½". The aerofilter plant at Cokato, Minn., has a primary tank 8'0" x 22'0" x 7'6"; and the one at Menominie, Wis., is 8'0" x 25'0" x 8'1".

Link-Belt Co. has manufactured clarifier equipment for a number of small rectangular tanks. The one installed at Roscoe, N. Y., to serve a population of about 700 with an estimated maximum summer flow of 70,000 gpd, is, shown in Fig. 3. The drive on this unit was powered by an air-cooled engine, since electricity was not available at the plant site. Fig. 4 shows the Waverly, Va., installation which

was designed by R. Stuart Royer to serve 2,200 people. This is a primary clarifier constructed in conjunction with a sludge digestion tank. A similar installation at Tappahannock, Va., also designed by Mr. Royer, serves a population of 800.

Ralph B. Carter Co. manufactures equipment for circular clarifiers as small as 20 ft. in diameter and 6 ft. deep, providing a capacity (allowing for the bottom slope) of 1,971 cu. ft., or small enough to serve about 1,200 people.

Dorr Co. makes a variety of small equipment. For the Duo-Clarifier, Fig. 5, it is made in sizes from 10 ft. diameter to 40 ft.; and for the Clarigester, which is a two-story tank, essentially a mechanical Imhoff tank, it is made as small as 12 ft. in diameter, with a sidewater depth in the settling compartment of 5 ft., and in the digestion compartment of 7 ft. Dorr circular clarifier mechanism is made in diameters from 10 ft. up. Recent small municipal installations include a 24-ft. diameter, 8-ft. deep clarifier at the Schenley Distilleries in Kentucky, to treat a flow of 325,000 gpd.; a 25-ft. diameter clarifier at Oak Creek, Colo.; a 22-ft. and a 14-ft. clarifier, both 7 ft. deep, at Westby, Wis., to handle flows of 252,000 and 100,000 gpd.; a 16′ x 6′ clarifier at a lumber plant at Goodman, Wis., to handle a flow of 80,000 gpd., and a 20-ft. diameter unit to handle a flow of 100,000 gpd. at Muroc Airfield.

Jeffrey Mfg. Co. makes equipment for rectangular tanks; this company furnishes a special type of equipment for small installations requiring tanks up to 10 ft. wide and 50 ft. long, maximum. The small plant installed at Fenton, Mich., was illustrated in last month's issue. The tank for the Laguna Madre Ground Range, which was of this type, is 23 ft. long and 9 ft. 10½ ins. wide with an average depth of 6 ft. 9 ins.

Yeomans Bros. "Rim-Drive" clarifier equipment is made for tanks of inside diameters of 15 ft. and larger, and in depths 6 ft. and greater; also, this company makes equipment for rectangular settling tanks. The 15-ft. circular tank has a capacity of about 1,100 cu. ft., allowing for bottom slopes, with a sidewater depth of 6 ft., and is suitable for a flow of about 100,000 gpd., with 2 hours detention based on average 24-hour flow; or about 67,000 gpd., based on the flow occurring in 16 hours.

Infilco, Inc., manufacture equipment for settling tanks of a size to serve populations of 500 persons or more. The Lake Geneva, Wis., plant, shown in last month's issue, uses 28-ft. circular tanks.

American Well Works furnish equipment for rectangular settling tanks, but we have no data on the smaller units available.

Lakeside Eng. Co., who make the Spiraflo clarifiers, report units in operation with diameters of 13 ft. to 58 ft. The 13-ft. unit is at North Bend, Nebr. It provides a detention period

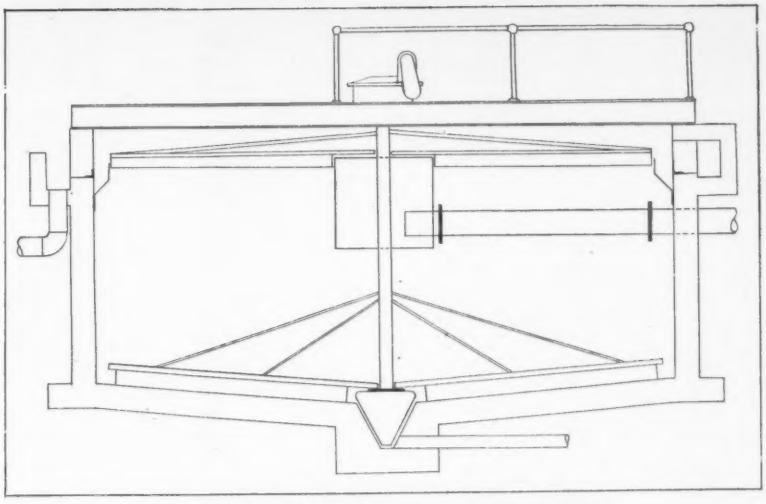


Fig. 1. Circular tank, 26 ft. diameter, Hardinge equipment.

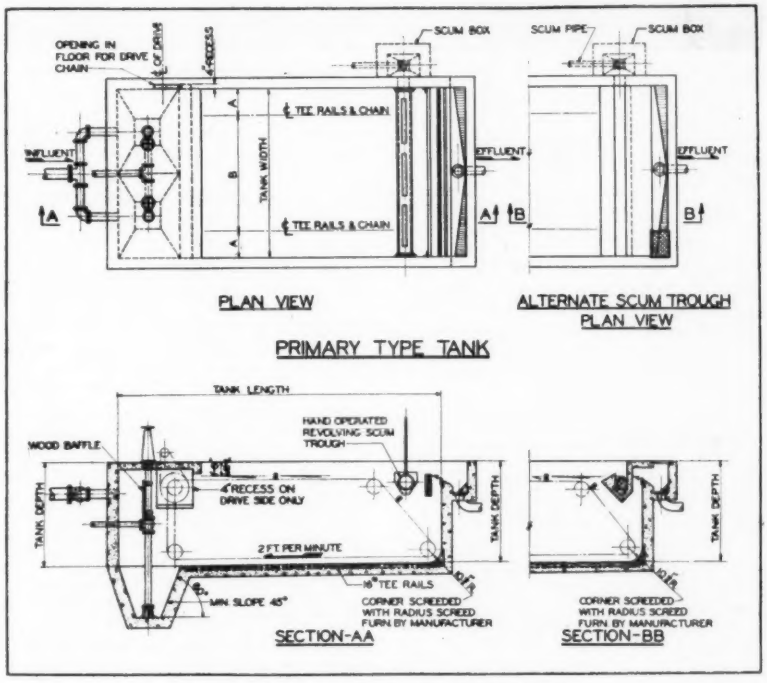


Fig. 2. Chain Belt equipped rectangular clarifier.

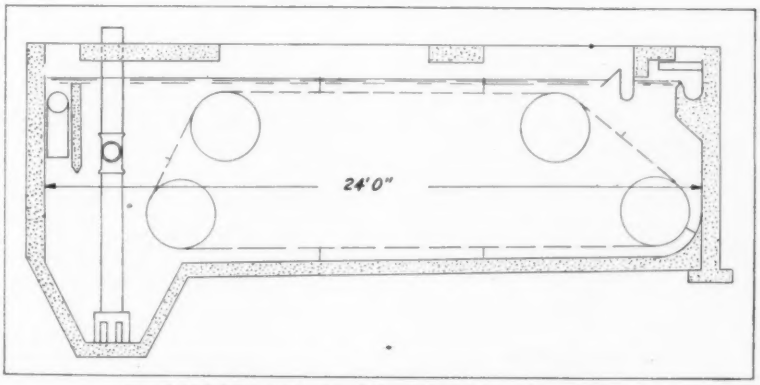


Fig. 3. Link-Belt equipped tank for 700 people at Roscoe, N. Y.

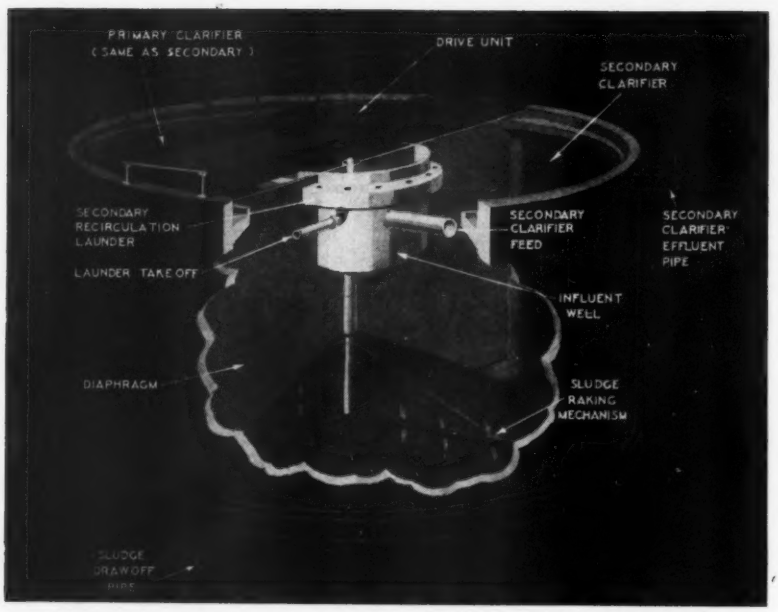


Fig. 5. Phantom view of Dorr "Duo-Clarifier," with primary and secondary tanks using the same mechanism.

of 1.3 hours. A hexagonal unit, with a short diameter of 28 ft., is in use at Flora, Ill.

Advantages of Mechanical Equipment

The mechanically equipped tank, as described above, had advantages over Imhoff tanks in a number of respects. Though regular operating attention is essential, this may be an advantage in securing better operation and avoiding the neglect that is the lot of so many sewage treatment plants.

The most usual advantage is in construction. It is scarcely possible to design an Imhoff tank to treat flows of 50,000 gpd. or more with a depth below the flow line of less than about 21 feet. In order to obtain adequate grades for the sewer system, the treatment plant must often be located in low ground. It is a major operation—and frequently a costly one—to install an Imhoff tank to a depth of 25 ft. or more (allowing for the depth of the sewer), especially in low ground. The shallow rectangular or circular tank may require only 8 to 10 ft. of excavation, plus a small extra amount for the sludge hopper and outlet.

Imhoff Tank Design

Settling or detention periods for Imhoff tanks are generally the same as for mechanically equipped primary tanks. New York and Alabama, however, require 2½ hours detention for Imhoff tanks as compared to 2 hours for mechanically cleaned tanks. There is little uniformity in the requirements for gas vent areas or slope of settling compartments. Alabama and Texas require a width of 18 ins. and an area, for the gas vents, 20% of the sludge compartment area; Colorado requires 24 ins. and 30%; Wisconsin 24 ins. and 10%; and South Dakota 24 ins. and 25%. New Mexico requires 25% to 30% of the settling compartment area.

The slope of the settling compartment is fixed at 1¼ vertical to 1 horizontal by Alabama, Connecticut and Idaho; at 1:1 by Colorado; 1½:1 by South Dakota; 1¾:1 to Kansas; and at 60° by Texas. All states require the sludge discharge pipe to be 8 ins. in diameter; the hydrostatic head on the sludge discharge pipe is 4 ft. in Alabama and Connecticut and 5 ft. in Colorado, Kansas and Texas.

Sludge compartment capacity will be discussed in the article on sludge disposal, which will appear in an early issue.

Overflow Rates

Overflow rates in gallons per 24 hours are obtained by dividing the 24-hour flow by the area of the tank in sq. ft. Thus, a 15-ft. circular tank has a surface area of 177 sq. ft., and the overflow rate would be, for a flow of 100,000 gpd., 100,000 ÷ 177 or about 565 gals. per sq. ft. per 24 hours. The detention period and the tank depth influence the overflow rate in most cases. The detention period in hours being known, the depth can be determined by:

Overflow Rate = 180 x D ÷ detention period, where D is depth. Assuming a detention period of 3 hours as proper for very small plants, an overflow rate of 600 gallons per 24 hours would permit a depth of 600= 60D, or 10ft. On small plants, such depth is not necessary, nor generally economical, and a shallower tank can be used—say 6 ft. This would permit a much lower and more favorable overflow rate. For instance, 180 x 6 ÷ 3 = 360 gallons per sq. ft. per 24 hours. On large installations, a rate of 800 is good practice. Only five of the 20 states reporting limit the overflow rate. In gallons per sq. ft. per 24 hours there are: Florida, 900; Kansas, 750; Oklahoma, 650; South Dakota, 800; and Texas, 900.

State Requirements

Florida recommends "a detention period of 2 hours . . . for primary settling tanks, based on an average 16-hr. daytime flow through the tank, includ-

(Continued on page 30)

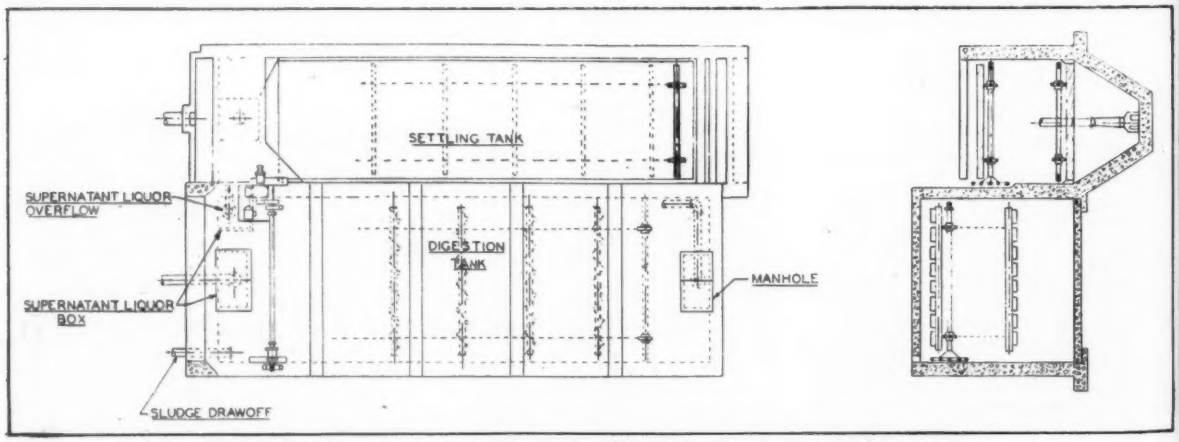


Fig. 4. Rectangular settling tank and digester, for 2200 people, Waverly, Va., Link-Belt equipment.

Essentials of Foundation Design in PERMAFROST

JOSEPH D. LEWIN

This is the second article in this series. The first discussed the basic factors in connection with permafrost and introduced a discussion of the elements of foundation design, which is concluded in this installment. Data are presented on simple foundations, foundations on receding permafrost, and foundations in permanently frozen ground.

Next month, the essential factors in dam design will be taken up, including estimation of probable ice thickness, recession of the permafrost level under reservoirs and dams, and details of dam construction, including drainage, cooling of dams, methods of insulation, and protection against ice damage.—The Editors.

SOIL stratification in the arctic is similar to that in other areas. Each stratum has its own physical characteristics and it compresses, settles and swells in a normal way. However, in a frozen state all strata react alike and their different characteristics appear only as they thaw. Therefore for the proper selection of a foundation it is necessary to know not only the datum of the permafrost table, but also the different soil stratifications, their moisture contents, their thermal characteristics and the temperatures at different depths. Foundations can be classified into three groups:

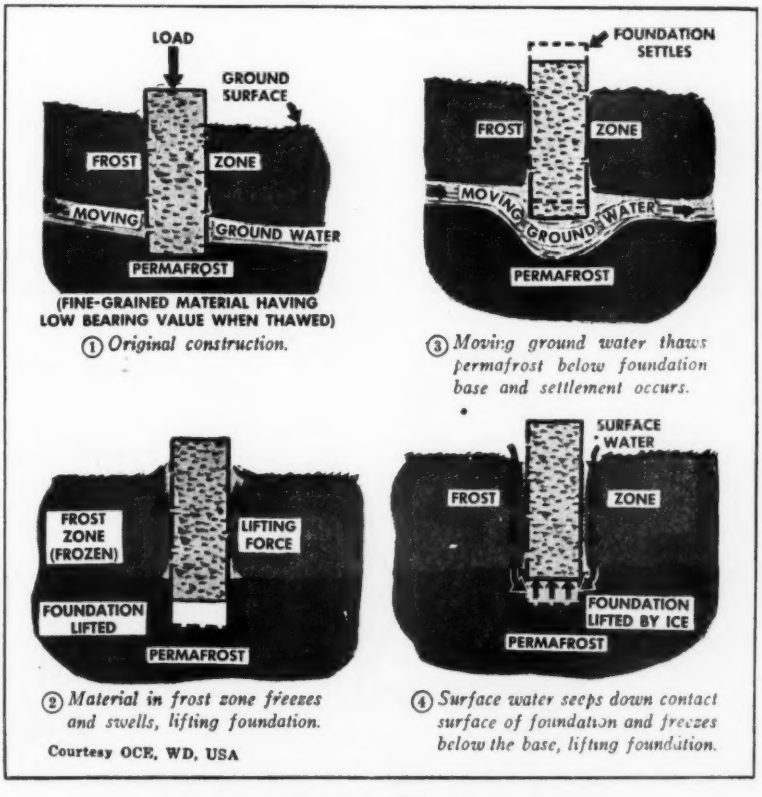
1) *Simple foundations,* such as used for small dwellings, single story wooden houses, farm structures, barns, etc. Such foundations are shallow and are placed on the active zone, upon removing of vegetation or top soil. Foundations can be either continuous, consisting of wooden logs placed longitudinally in two or several layers, or discontinuous consisting of pyramided piers or chairs built up of wooden logs or of cut timber. In case of swellings such foundations give and deform. However, such deformations are acceptable for wooden structures. Log cabin type structures are rigid enough to withstand differential settlement by tilting. Frame type structures are flexible enough to conform to such settlements. In some cases, diagonal bracing improves their resistance. Where the permafrost table is high, chairs or piles can be used advantageously.

2) *Foundations on receding permafrost.* Such conditions occur in southern fringes of the permafrost area, where frozen strata are thin and would defrost completely under the structure. Also in cases of structures with large amounts of liberated heat, such as furnaces, rolling mills, steel plants, foundries, power houses, kilns, etc., the permafrost stratum can be thawed to such a depth, as to make it practically non-existent.

If the thawed layers have the mechanical properties of plastic soils (settlement with a gradual ultimate value), foundations can be erected and the future settlements predicted with reasonable accuracy. Footing sizes are determined by the bearing capacity of the thawed soil. The settlement of the structure will differ from one on normal ground in that the various footings settle unequally until thawing reaches the depth of foundation.

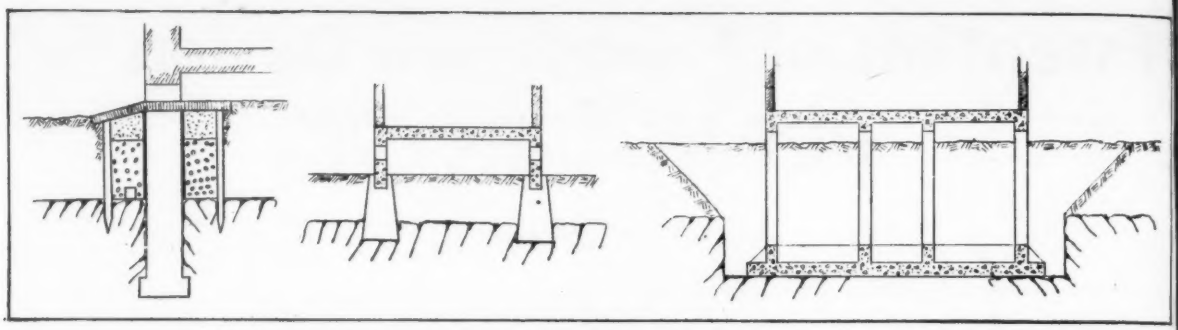
To predict such future settlements both laboratory and field tests are conducted. In the field, loading tests on frozen and thawed soil disclose the bearing values of the soil. Laboratory tests establish the consolidation values due to loading and the initial settlement due to thawing. For such tests the soil mechanics laboratory has to be equipped with special testing equipment. In the field the ground under the bearing plate can be defrosted by steam jets or electric heaters sunk into wells or casings. While field and laboratory tests are conducted, temperatures and heat-input are recorded.

Should the permafrost stratum thaw into a soft mud with a very low bearing value, any foundation would



Courtesy OCE, WD, USA

Lifting and settling of foundations on permafrost.



Foundation types in permafrost: Left, column footings; center, with air space under floor; right, on a mat.

squeeze out such mud from under its footing. The structure would sink until the entire permafrost layer is defrosted and displaced and the footing has reached a bearing stratum. It is not unusual that the soft, liquid mud is displaced into the space under the floor and can lift, bend and destroy it. With such soil, it is necessary to cut through the permafrost layer and place the footings on solid ground beneath it. If the solid bearing ground is at a great depth, consideration should be given to a floating foundation (inverted arches, inverted caissons, etc.), or another site should be selected. An alternate method would consist in preventing the thawing of the permafrost. Attention should be given to other causes of thawing, besides the input of heat from the structure. Thawing can also be caused by such natural occurrences as changes of ground water levels, changes in vegetation or less snow cover in the vicinity of the structure.

Permanently Frozen Ground

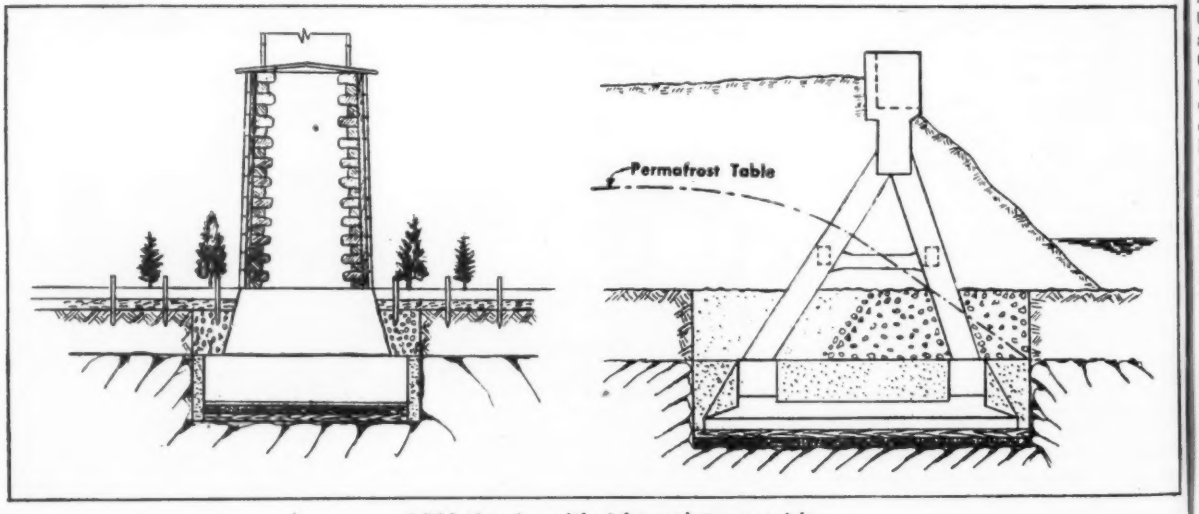
3) *Foundations in permanently frozen ground.* This can be accomplished under the following conditions: a) The structure should have a ventilated cellar or an air space between the ground and the ground floor. b) Foundation members (columns, etc.), should have the smallest cross-sections possible and be of materials resisting tensile stresses. The materials should have a low thermal conductivity, so that the total heat transfer from the building into the ground is low. High strength materials (such as 6,000 to 10,000-pound concrete) should be investigated as to whether or not they would produce a low heat transfer.

c) Measures should be taken to decrease the heat transfer from the structure into the ground. Since a part of the heat is transferred by foundation columns and walls, they have to be of smallest cross-sectional area. Furthermore, heat can travel from the floors of heated rooms into the ground upon which such floors are placed. Air space of not less than 1½ ft. should be provided under floors, and such an air space should be well ventilated. The purpose of a ventilated air space is to permit the cold air during the winter season to enter the space and to undercool the soil beneath it. Such undercooled ground warms up slowly during the summer. It has been observed that the ground temperatures under and outside buildings constructed in this way are about the same, so that the permafrost regime is not affected. If the building area is so large that ventilation of the air space is inadequate, additional flues in the building can be installed to improve winter ventilation. Further undercooling of ground can be achieved by burying draft pipes for winter circulation. The foundation under hot floors can be improved by providing laminated aerated flooring, insulated floors, cooling systems, forced ventilations, etc.

Pier and pile foundations should penetrate not less than 1½ ft. below the permafrost table. To prevent their pulling out by swelling forces above the permafrost table, the foundation depth can be increased, or the footings can be enlarged. If the bearing capacity requires large footings a continuous mat foundation should be investigated, with the buildings supported on thin columns or piles resting on the mat. To increase the rigidity of the mat ribs can be provided. Vertical members resting upon a mat or ribs should be securely anchored to prevent lifting up by swelling forces.

Structural Details

Foundations in permafrost should satisfy three design conditions: a) The foundation should resist the swelling forces so as not to be pulled out or pushed out of the ground; b) The foundation should be insulated against direct contact with active zone frozen ground, first to reduce the adfreezing



Solid bridge pier at left; A-frame abutment at right.

forces, secondly to decrease the heat transfer; and c) The foundation should consist of piers or piles to speed its cooling off and also to reduce the heat transfer into the ground.

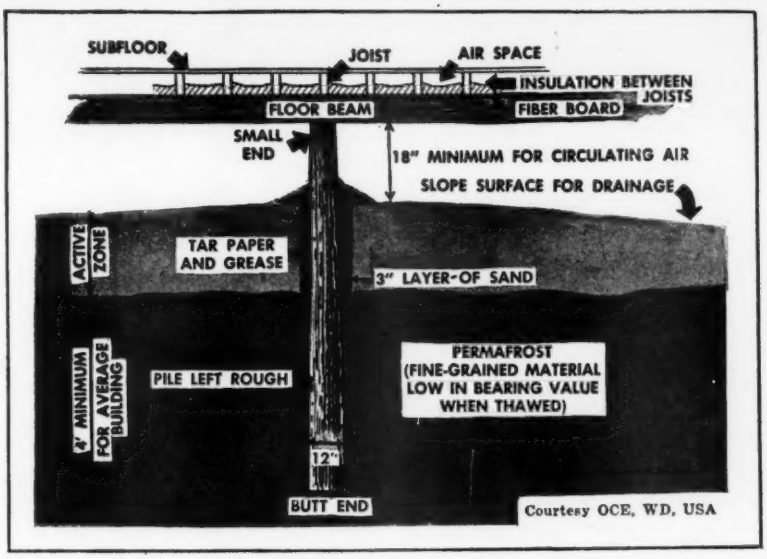
In regard to insulation, the Russians prefer wood. It has a low coefficient of conductivity. It is not subjected to decay when frozen. However, this preference to wood can be explained by the abundance of timber in Russia and a lack of mineral or inert insulation materials. Rockwool, spun glass, glass fiber, and impregnated felt, are more efficient as insulation materials and are immune to destruction in the active zone. Their cost however is high and increases with the inaccessibility of the construction site.

Bridges do not produce any heat, however they absorb solar radiation and transmit solar heat to the ground. To prevent it, piers can be protected by timber cribbing. Such insulation is necessary if the permafrost has only a slight negative temperature. Providing shade by planting bushes, trees, etc., is effective where these will grow. Bridge abutments of the A-frame type have advantages. The A-frame is protected from the solar radiation by backfill. The small cross-sectional area transmits little heat. The construction is light and the dead load of abutment is only a small percentage of the weight of the bridge structure it supports. Such construction permits the use of prefabricated frame sections, thus allowing for controlled curing of concrete. With proper aggregates, proper proportioning and close control of manufacturing, such prefabricated concrete members show ultimate strength from 6,000 to 12,000 psi. This results in higher allowable stresses and smaller dimensions of structural members.

Protection Against Adfreezing

Protection of foundations from adfreezing to the active zone is of special importance. Piles can be wrapped with insulating material and covered with tar paper thus forming a collar or muff around the upper portion of the pile. Other foundations can be backfilled with coarse gravel, slag, broken stone or other coarse materials which drain easily. Coarse backfill can be separated by timber sheeting from the active zone. The base of the active zone should be drained. Apart from insulation, foundations can be built with sloping sides, widening on the bottom. The sloping sides develop the downward component of the side thrust thereby resisting lifting force.

Pile foundations are economical under arctic conditions. Piles are steam-jetted into the permafrost stratum. When the thawed permafrost freezes again, it adfreezes to the pile thus providing a high skin friction of the pile. Usually the piles are so solidly frozen to the permafrost that they resist any swelling action. Bearing capacity of piles is computed as friction type piles without any support at the footing.



Typical design of structure in permafrost.

Foundation Design

Foundations in disintegrating permafrost and foundations projecting through the permafrost are designed as normal foundations. The geological and soil mechanics investigations determine the proper foundation datum and the allowable soil bearing loading. If foundations are placed in permafrost subjected to thawing, it is necessary to determine the probable settlement due to thawing of ice layers. The prognosis of settlement can be made after the consolidation coefficient has been established for thawed soil.

If permafrost is maintained, the foundation design follows another path. The subsoil investigation determines the desired depth of foundation. This depth should not be less than 1.5 to 3 ft. below the permafrost table.

Thermal Conductivity of Materials in Btu. per hr. per sq. ft. for a temperature gradient of 1°F per ft.

Material	*Conductivity*
Asbestos	.122
Asbestos boards	.07
Brick Masonry	.33 to .42
Cement	.17
Coke Breeze	.341
Concrete, Cinder	.167 to .42
Concrete, Stone	.5 to .75
Concrete 1:2:4 mix	.691 to .694
Wool Felt	.03
Granite	.425
Ice	1.26
Kapok	.02
Mineral Wool	.023
Sand, dry	.188
Stone, Portland	.458
Stone, York	.583
Wood, across grain	
Balsa	.03
White Fir	.062
Yellow Pine	.085
Wood, along grain	
White Fir	.215

Tests will determine the allowable soil bearing values at this datum. Thereafter, the height of the aerated subflooring, the floor construction and the foundation, are determined and checked for three design criteria:

1) Compute the thermal conductivity of the floor system and establish the thermal equilibrium. N. A. Tsytovich gives in his book, "Osnovaniya Mekhaniki Merzlykh Gruntov," a detailed computation procedure which takes into consideration the soil temperature, moisture and unit weight of soil strata, and air temperature.

By the Tsytovich method the annual thermal balance is computed for loss of heat during the winter season and the heat gain during the summer season. Thereafter it is possible to determine the required thermal conductivity coefficient of the floor and choose properly the materials and construction method for the floor slab. Russian experience seems to indicate that with an aerated space of 1.5 to 3.0 ft. height and a foundation footing not less than 1.5 ft. below the permafrost table, the permafrost condition is maintained.

2) Determine the required depth of penetration to resist the lifting forces of swelling ground. A pile is stable when the unit adfreezing strength in permafrost times the surface area of the pile in permafrost, plus the load on pile, is greater than the unit adfreezing strength in the active layer times the surface area of the pile in the active layer.

3) If the first approximate computations cast a doubt as to the maintenance of the permafrost, special computations should be made as outlined by Tsytovich.

Construction Methods

Construction methods differ considerably from the normal procedures. In order to avoid expensive shorings, ex-

Heat Required to Defrost Ground

Weight of dry sand assumed at	105 lbs.
Voids in sand assumed	50 %
Ice assumed to fill 80% of voids	40 %
Unit weight of ice 62.5 x .9	56 pcf.
Weight of ice in ground .40 x 56	22.5 lbs.
Temperature of frozen soil assumed at	31 F.
Temperature of thawed soil assumed at	32.5 F.
Heat to raise ice from 31° to 32° (specific heat .487 BTU/lb./F.°, or 22.5 lbs x .487 x 1°	10 BTU
Heat requirement for melting ice (heat of fusion 144 BTU/lb. 22.5 x 144	3240 BTU
Heat for raising water from 32° to 32.5° specific heat 1.0 BTU/lb./F.°) 22.5 x 1.0 x .5°	11 BTU
Heat for raising earth from 31 to 32.5° (specific heat .195 BTU/lb./F.°) 105 x .195 x 1.5°	31 BTU
Total theoretic heat demand	3292 BTU/cf
Because of heat losses assume efficiency of 50% Actual heat demand	6584 BTU/cf

cavations should be performed during the winter season if possible, thus utilizing the higher stability of frozen ground. To excavate the ground, it merely needs to be thawed. In Russia, fires built upon metal sheets. The thawed ground under the fires is excavated by hand. This method can be used advantageously in remote locations and on small jobs, where it would be uneconomical to transport modern equipment. Blasting or jackhammers are not very effective because the frozen ground is resilient. Therefore, on larger projects, the ground can be thawed either by steam jets or electrically heated needles. For steam jets, 1" to 2" pipes are connected by a flexible hose to a steam header and to the steam generator. Steam pressure is maintained at 60 to 90 psi. The jet pipe is placed vertically into the ground and sinks in as the ground softens under the effect of heat and steam. The rate of thawing averages about 1 ft. in 10 minutes. The result is a thawed cylinder about 2 ft. in diam. The steam demand averages 18 to 20 cf. per ft. of penetration. Electric needles consist of a steel bar ¾" in diam. covered with a ⅛" layer of asbestos. A heating wire is wound around the asbestos and covered again with asbestos. This heating element is placed in a 2" pipe, sealed at the bottom.

The heat requirement to defrost a cubic foot of ground varies with the unit weight of ground, void content, amount of ice in the voids, and the soil temperature. The computation is indicated in the accompanying example.

This heat demand can be supplied either by steam or by electricity. If steam is used at 60 psi: 6584 BTU/830 BTU / lbs., say 8 lbs of steam per cu. ft. of soil. If electricity is used: 6584 BTU / 3413 BTU / kwh., say 2 kwh. per cu. ft. of soil.

Steam jets can be also used for sinking caissons or caisson type piles. This is of practical importance where the active zone is water bearing and open excavation is complicated.

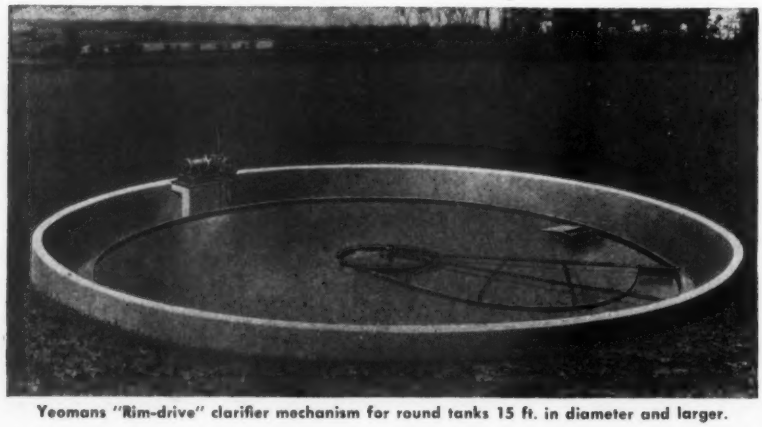
Small Sewage Treatment Plants

(Continued from page 26)

ing recirculation. . . . Surface loading should not exceed 900 gpd./sq. ft.; depth range should be 8 to 10 ft.; baffled inlet and outlet must be provided. . . . Imhoff tanks are not considered favorably for systems serving over 1,000 people." South Dakota requires 2 to 2½ hrs. detention for 16-hr. period of maximum flow and 800 gpd./sq. ft. overflow rate.

Connecticut requires "not less than 2.5 hrs." detention for single story tanks with separate sludge digestion but "3 to 4 hours is preferred." The same applies to Imhoff tanks. New York says: "Imhoff tanks designed for municipalities should have a detention period in the sedimentation compartment of not less than 2½ hours, based on the average flow of sewage; and single story sedimentation tanks 2 hours." For populations in excess of 1,000, "mechanically cleaned tanks are considered essential."

Alabama requirements state. "The sedimentation tank should have a detention period, based on average flow of at least 2 hours." The same detention period is required for Imhoff tanks. With plain settling tanks "sludge collecting equipment should be provided in all cases possible, also scum collecting equipment when practicable." Kansas urges scum removal facilities with mechanically equipped clarifiers. In Texas, "The detention period in a plain sedimentation tank should be 2 hrs. preceding trickling sand or aeration filters, and 1 hour preceding activated sludge." Additional capacity must be provided where recirculation is employed. "Special facilities for skimming and handling scum are highly desirable."



Yeomans "Rim-drive" clarifier mechanism for round tanks 15 ft. in diameter and larger.

Inter-American Sanitary Engineering Congress

The Chilean Section of the Inter-American Association of Sanitary Engineering has now announced that the First Inter-American Sanitary Engineering Congress will be held in the University of Chile, Santiago, Chile, April 8-14, inclusive. Sponsoring agencies of the Congress include the Chilean Section, the Ministry of Public Works of Chile, the Ministry of Public Health of Chile, the Department of Water and Sewerage of Santiago, the Pan American Sanitary Bureau and the Institute of Inter-American affairs.

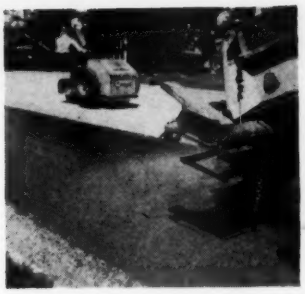
An exhibit of water-works and sanitation equipment will be held.

For further information on the Congress, inquiries may be addressed to the conference chairman, Mr. Ruperto Casanueva, Departamento Cooperativo Interamericano de Obras Sanitarias, Tenderini 127, Santiago, Chile, or to the Inter-American Association of Sanitary Engineering, c/o Donald L. Snow, Acting Secretary, 2001 Connecticut Avenue, N. W., Washington 8, D. C.

A City Paves With Its Own Equipment

In laying 270,000 sq. yds. of hot-mix paving, Fort Morgan uses its own plant.

GLENN S. WHITE
City Engineer



Applying chips with spinner.

THE City of Fort Morgan, Colorado, in 1944, purchased a full line of paving equipment for asphaltic pavement. Delivery was made on all of this equipment, except the finisher, by the early spring of 1946. Work was started in June, 1946, on paving a 271,230 square yard project (District 3). Work was discontinued in late Oct., 1946; again started May 12th, 1947; and was completed Oct. 16th, 1947.

The plant, a Barber-Greene (Model 840) with a dryer (Model 830), was set up on a railroad spur where the average haul to the project was 1¼ miles, and where 6,000 cu. yds. of mineral aggregate could be stock piled. The haul for aggregate was 1 mile.

The pavement consists of a 2-inch compacted mat of hot processed material. This was hauled to the job in dump trucks, 4¼ tons per load. In 1946 the loads were dumped on the sub-grade at measured distances and spread with a blade. In 1947 the loads were dumped directly into the finishing machine, which was delivered in time for the 1947 work. The finishing machine has many advantages and is well worth the cost. The laying of asphalt with a blade requires a high degree of skill and it is difficult to find an operator that can do a satisfactory job, though we were very fortunate in finding one. After the mat was laid, and thoroughly compacted with roller and by traffic, a seal coat was applied and covered with chips. The elapsed time between laying the mat and applying the seal coat ranged from one to five months.

The asphalt, of 160 penetration, came from the Wyoming oil fields, being shipped from Cody and Casper. When weather was cold in early spring and late fall we changed to 250 penetration. Asphalt was mixed with aggregate in the pug mill at a temperature of 300°, using an admixture of 4.34% of the weight of the mixed material. The seal coat consisted of 250 penetration asphalt applied at a temperature of 350°, at the rate of ¼ gallon per square yard.

Materials Used

Mineral aggregates were obtained from the South Platte River bottom. A 6″ centrifugal gravel pump, driven by a 50hp electric motor, was mounted on a platform floated on empty oil barrels. The 30 ft. suction pipe is equipped with an electric hoist for raising and lowering. The discharge pipe has two sections of flexible hose and is laid, from float to bank, on empty oil barrels allowing the pump to cover considerable area. Oversize stone and quicksand are eliminated by a grizzly and screens. The gravel pump operates summer and winter, the winter production being stock piled at the processing plant. Binder was obtained from a pit three miles from the processing plant and added to the other aggregates, through the hopper, at a rate of 6%. All aggregates were loaded into the hopper by drag line and were heated in the dryer to a temperature of 200°. Chips were also produced at the gravel plant, by changing screens, and applied on the seal coat, 15 pounds per square yard, by a spinner; then smoothed with a steel brush; and rolled.

The streets of Fort Morgan have been kept well graveled and shaped for the past ten years thereby forming a hard 6″ crust which was not disturbed. A 2″ cut was made at the gutter edge and feather edged from 5 to 7 feet out. The street was then lightly bladed to remove all loose material and smooth out small irregularities, the loose material being windrowed into the center of the street and removed, for use on other streets. This was picked up with a front end loader and handled in dump trucks. The street was then cleaned of all dust with a rotary broom and kept in that condition with the broom until the mat was laid. By doing this it was not necessary to use a tack coat as the mat did not slip; and the water level being at a depth of 60 ft., it was necessary to use a seal.

The finished crown varied from 12″ to 15″ according to the width of streets.

Gutter edges were painted with hot asphalt. All streets had been well drained by combined curb and gutter and storm sewer before laying pavement.

Labor Required

The following labor was required on this job: Processing plant, 4 men; finishing machine, 4 men, two operators and two handy men; truck hauling, 2 men (3 trucks were used, one standing by so any delay would not stop the plant); blade, 1 man; roller, 1 man; clean up, 2 men, with one truck to pick up loose material, change barriers, run rotary broom, etc.; painting

(Continued on page 38)

Left, laying mat with motor grader; right, surface spread and ready to roll.

Lewiston has Northwest's First Postwar Swimming Pool

Built on a cost plus 10% basis at a saving of about 15% of lowest bid. Detailed cost data.

WM. P. HUGHES
City Engineer, Member A.S.C.E., Lewiston, Idaho

THE construction of a modern swimming pool this summer at Lewiston, Idaho, a city of 14,000 people, created considerable interest to engineers, contractors and other municipalities in the Northwest. Besides being hampered by material shortages and bidding far beyond engineering estimates, the situation was further aggravated by many other accumulated project obligations which had been held in abeyance during the war years. With the ending of World War II, increased costs caused budgets to be adjusted and projects placed in line of importance. Increased taxes and other revenues were not in keeping with demands. Methods had to be devised to meet this situation.

The swimming pool project at Lewiston was sponsored by the Junior Chamber of Commerce, with approximately 25% of the funds collected by public subscription, and further supplemented by support from all the other civic organizations. The construction of this modern 50′ x 105′ swimming pool was given first priority in our building program.

Engineering estimates had risen from $35,000 before the war to $45,000 on "V-J" Day. The City voted a 2-mill levy to meet the new engineering estimate and bids were called, the lowest of which was $15,000 in excess of the engineer's estimate.

Bids Too High; What to Do?

Since there were not sufficient funds to proceed, a special meeting of the City Council was held and the City Engineer authorized, at his recommendation, to proceed on a cost-plus basis. Because of the courage and foresightedness of the Mayor and Council, who had faith in their Engineer, Lewiston can now boast of a new modern swimming pool with a beautiful connecting 50′ x 70′ fireproof bathhouse which also houses the filter equipment. It has also been the answer to the prayers of some 15,000 young people who have already bathed in its sparkling pure water.

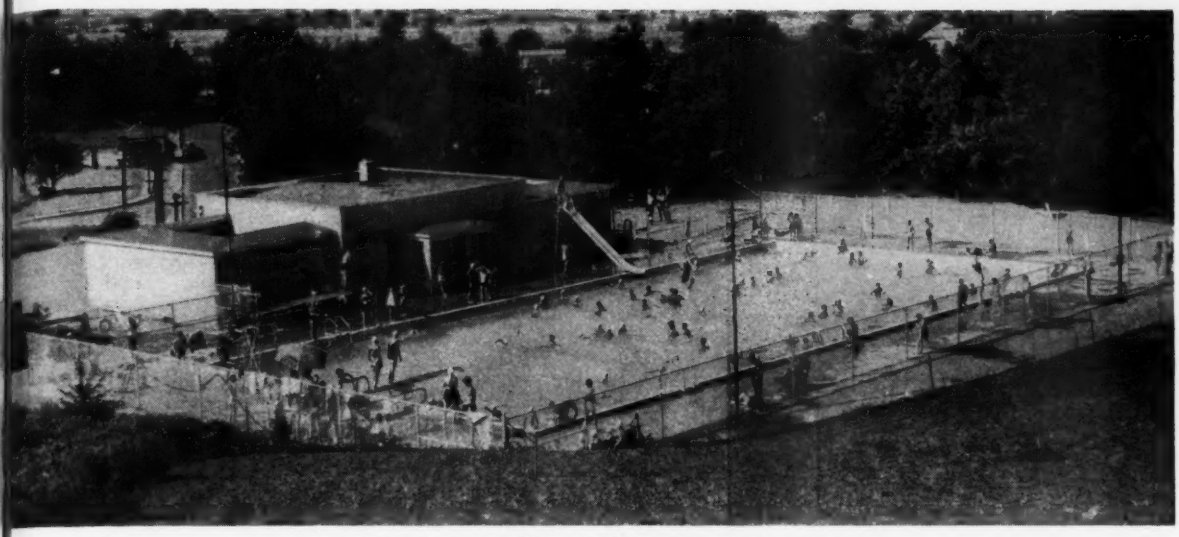
The writer is not an advocate of cost plus under normal conditions, but these are abnormal times with ever changing prices in both material and labor. Contractors are up against this situation and want to play safe—possibly to the extreme. Cost plus is one way out under these conditions. It is an opportunity for an engineer to show his employer the value of his training in achieving results, and to vindicate his cost estimates. Cost plus affords a leeway for protection against possible rising costs and non-availability of materials that has caused (and still is causing) bids on all types of projects to exceed greatly the estimates of engineers and that has forced abandonment or postponement of many projects during the past two years.

Lewiston completed its swimming pool at a cost of $53,677, some $10,000 under the lowest firm bid. Also, it must be said that the actual difference is at least $3,000 greater than was anticipated because of the increase in the standard of design for the bathhouse.

During the construction of the Lewiston swimming pool, bids were being received and rejected all over the Northwest—at Blaine and Bridgeport in Washington, and LaGrande, Hood River and Eugene, Oregon, three times. Forest Grove attempted to take bids and also had to reject them as being too high. Laurel, Montana, officials wanted to build a $25,000 pool and had to postpone it. Dayton, Pasco, and Kennewick in Washington all have been trying to build pools since the end of the war, without success.

Since Lewiston has grabbed the bear by the tail and showed that *it can be done* without accepting exorbitant bids, it is very likely that there will be a parade of Northwest cities building

The pool under construction. Cost of concrete averaged $39.95 total per yd.



The first postwar swimming pool in the Northwest draws a crowd.

pools in 1948. In fact, from letters seeking information through this office, we feel that most of the above mentioned cities will get pools underway this coming spring.

Construction on Cost Plus 10%

The pool was designed to be 50′ wide by 105′ long; walls varying in depth from 4′ to 8′7″, 12″ thick at the bottom and 10″ thick at the top, set on footings 10″ and 12″ thick. To provide necessary health safeguards, 3 vertical 96″ steel pressure unit filters, and a 10 pounds per 24-hr. chlorinator were specified. The filter house, adjoining the pool on the north side, was to be of reinforced concrete construction with a concrete beam slab roof to serve as floor of the bath house. The bath house was designed as a one-story structure 73′4″ x 30′, of concrete block construction with steel sash windows and a composition built up flat roof. Equipment included an oil hot water heater, six showers, toilets and a check room. Additional facilities included a concrete sidewalk around the pool, and a 6′ high steel mesh fence for protection against vandalism.

First construction commenced early in August, 1946, with bulldozers and an Insley shovel excavating for the pool and extending water and sewer facilities. Forms and steel were placed for the filter house and the concrete was poured (as it was throughout the job) by use of 2-wheel buggies working from Jaeger transit-mix trucks of the American Transit Mix Company of Clarkston, Washington, Lewiston's twin city across the Snake river. With an average crew of 4 carpenters, 3 laborers, 1 concrete finisher, and a supervisor, concrete for the filter house was poured at a rate that reached as high as 77 cu. yds. per 8-hour shift. and concrete for the pool later was poured at a rate reaching 32 yards per shift. The filter house was poured before winter freezing weather, the pool was poured and the concrete blocks laid in the bath house during the spring of 1947.

Concrete slabs in the filter house, bath house and floor of the pool were finished by hand float. As an aid in assuring water tightness and perfect concrete, the forms were blown out with compressed air immediately before each pour. Concrete was vibrated by an electric vibrator during the pour in the sidewalls.

Construction Procedure; Costs

A concise breakdown of construction procedure and costs follows: The excavation for the filter house proper was done by a hoe and a dozer, working in blowsand soil. They moved approximately 600 cu. yds. of earth at a total cost of $171 or 28.5¢ per yard.

On October 14, 1946, actual erection of the structure was started, and 24½ cu. yds. of dirt was removed by hand for the filter house footing at a cost of $36.23. Labor to build forms cost $91.75; form material, $25; concrete, $230.63 for 22.5 cu. yds.; labor to place concrete was $62.19. With 10% profit for the contractor, total cost for the footings in place was $490.38, or $21.79 per cu. yd.

Cost of the reinforced concrete walls for the filter house is broken down as follows: $900.29 for labor; $275 for form material; $480 for reinforcing steel; $154.28 for placing of steel; $717.50 for the 70 cu. yds. of concrete; and $288.71 for the contractor, making the total of $2,815.78, or $40.225 per cu. yd. for a 70-yard wall.

During the 48-hour wait for the filter house walls to take their initial set, the ramp wall footings were poured at a total cost of $185.36 for 4 yds. of reinforced concrete in place.

The roof of the filter house was a reinforced concrete slab that would also serve as a floor for the bath house. Cost of form material was approximately $280; reinforcing steel bent and placed cost $669.32; labor for forming, placing and finishing the floor slab was $801.79. Cost of 47½ cu. yds. of concrete was $482.13; the cost of placing plumbing and floor drains was $83.29; and the electrical work, costing $156.71, boosted the total to $2,629.71 with the contractor's profit of $156.47. Cost of the reinforced slab in place was $50.298 per yd.

Prices, Except for Concrete, Increase 10%

The fear of approaching freezing weather then brought progress to a near standstill, with the ramp wall

(Continued on page 54)

COST OF FOOTINGS, WALLS AND SLABS

ITEM	Forms, sq. ft. Area	Total Cost	Unit Cost	Concrete, cu. yds. Yds.	Total	Unit Cost	Steel, lbs. Lbs.	Total	Unit Cost	Total Cost Total	Per Yard
Footings ...	1030	483.56	0.569	65	1050.64	16.164	3963	366.58	0.0925	1900.78	$29.243
Walls	3960	3303.86	0.834	87½	1737.29	19.855	11700	1082.25	0.0925	6123.40	69.982
Slabs	360	425.03	1.181	129¼	2311.02	17.880	5360	495.80	0.0925	3231.85	25.005
TOTALS ..	5350	4212.45		281¾	5098.95		21023	1944.63		11256.03	$39.950

Courtesy Buckeye

TRENCHING EQUIPMENT

Trenchers and backhoes suitable for excavating for water and sewer lines. Cost estimating when using mechanical equipment.

Lower costs and faster work are assured by the use of trenching equipment. Under present-day labor and wage conditions, it is an unusual job where a machine cannot do the work both much faster and much cheaper than it can be done by hand—that is, by men with picks and shovels. This article, describing some of the types of trenching equipment, has been prepared to show our readers what is available and to give some basis for estimating costs.

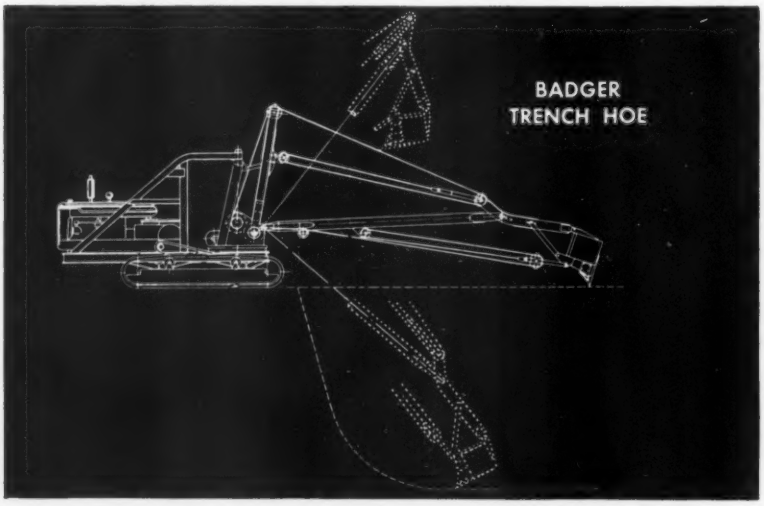
THREE sizes of ditchers are made by Cleveland Trencher Co., the 140, the 110 and the 95, the last-named being the smallest. All of these are wheel-type. The 140 will cut from 17 ins. minimum to 30 ins. maximum width, and to a depth of 5'4". This unit has maintained a rate of 1000 feet per hour in caliche soil on a Texas job. The 110 will cut from 11" to 24" wide, and to a depth of 5'6". The 95 cuts the same width and depth as the 110, but is lighter in weight and somewhat smaller. All of these units will cut close to trees, curbs or other obstructions.

Parsons Company makes boom type trenchers, the Models 221, 250 and 310; and also a wheel type, the Model 200. This latter will dig from 15" to 26" wide and 5'6" deep. No data are available to us on performance. The 221 will cut normally 16" to 24" wide; with special buckets, up to 30" wide; with sidecutters to 36"; and to a depth of 8'0". The 250 will cut to 42 ins. maximum width and to a depth of 12'6". The 310 will cut from 18" to 54" wide and to 15'0" deep.

Buckeye Traction Ditcher Co. makes boom type ditchers. The 200 series are the largest and will cut from 24" to 84" wide and to a depth of 24 ft. The 160 is also a large unit. The 120 can cut from 18" to 48" wide, the latter when using special buckets, and to 11'6" deep. This unit is reported to have made 50 ft. an hour in a Saginaw, Mich., job, 24" wide and 4' deep, cutting through a concrete pavement. This average is said to include the need for undercutting curbs, driveways, conduits and service pipes as well as loading spoil into trucks. The 410 is a small unit, designed for city work. It cuts from 18" to 24" wide and up to 6 ft. deep. A new unit, the 312, has just been announced by Buckeye. This is wheel-type, and cuts 16" to 30" wide and to 6 ft. deep.

Cost Data on Trenching

Barber-Greene makes several models of vertical boom ditchers; these dig straight down. The 44-C is the standard unit; it cuts ditches 12" to 24" wide and to 8'3" deep. This is also made in a "Pipeline Special" for cross-country oil and water pipe digging; which cuts to 5'6". Plenty of cost data are available on the operation of the 44-C machines. On a job near San Antonio, Texas, the 44-C averaged 150 ft. per hour on a 24" by 7' deep trench. On an airport drainage job, it averaged 3600 ft. per 12-hour day. In cutting house connections, 41 trenches each 18" wide, 7 ft. deep and 18 ft. long were cut in 6 hours and 10 minutes. Other examples are 200 ft. a day through a brick street, and 100 ft. per hour through asphalt. You can figure your own approximate costs for your own job. Allow 50% of the original cost of the unit per year of operation (20-23% for depreciation; 7% for interest, insurance, and taxes; 5% for miscellaneous; 15% to 18% for repairs) and divide by the number of days used per year. A good average is 130 to 150 days. This will mean $30 to $35 per day for overhead depending on first cost. Add operation, including fuel and operator and helper. Divide by the number of feet per day. For average going allow 300 to 400 ft. per day; more for good conditions. Based on pre-war costs, Barber-Greene reports, based on a study of 7 typical jobs, costs of 3.8 to 8.1 cents a foot. Present costs will be higher.



Austin-Western "Badger" trenchhoe, showing possible depth of cut.

Trenchhoes From Power Shovels

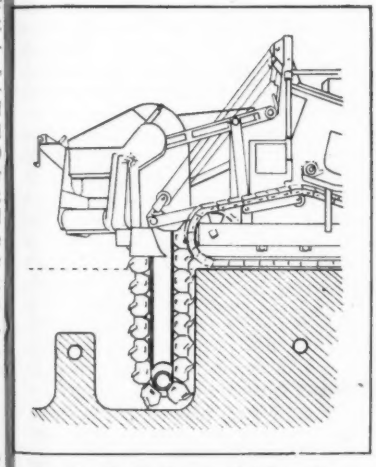
Many of the power shovels of the boom and bucket type can be used for trenching work, thus making them even more useful to the city or county. There are a great many such shovels made; for the purpose of reducing the length of this article, only half-yard or smaller shovels will be discussed here, though there is no reason why a larger unit cannot be used, and on the larger jobs it may be desirable. An advantage of the shovel is that it can also be used to handle heavy pipe into the trench. The front-end loader type of shovel cannot ordinarily be used for trenching. However, they are useful and economical for backfilling.

The Austin-Western Badger ½-yd. shovel, when converted to a trench hoe can dig to a depth of 13'10" below the level of the crawlers. Standard bucket width is 30" but a 24" bucket can be supplied for trenching. The Link-Belt Speeder (LS-50) is a ½-yd. shovel. It will cut 30" wide and to a

depth of 12′ when using a 14′ boom. On a water main job in Oregon, one of these trench hoes averaged 1000 ft. a day. This same type of machine can be furnished truck-mounted—the UC-55.

Bay City makes ⅜ and ½-yard shovels convertible to trench hoes (also larger units). The Buckeye Clipper trench hoe cuts 31″ or 36″ wide and to a depth of 15′. Insley has a K-12 machine called the "basement hoe," which is suitable for trenching. The standard bucket is 30″ wide, but a 24″ bucket can be supplied. This machine will cut to a depth of 12′ below grade. The Keystone Driller Co. 18A skimmer-hoe-crane will cut to a depth of 24′ in good ground, but for average work a 21′ boom is recommended; and for hard ground an 18′. The Unit 514 ¼-yard machine will cut 15′6″ deep and has a 31″ wide bucket. The Unit 357 Mobile Crane will dig 14′7″ over the side and 13′0″ over the drive end.

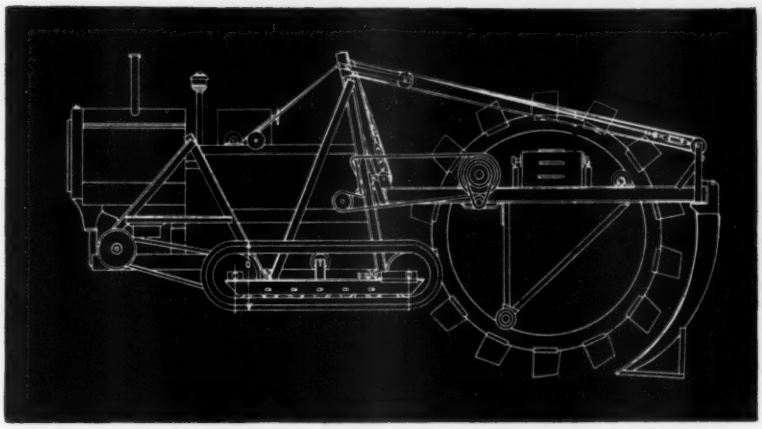
General has a number of units equipped with trench hoes. The 105 is mounted on rubber tires and is highly mobile and useful for small jobs. The Osgood 50, ⅜-yd. unit has a maximum digging depth of 12′ with a 24″



How the Barber-Greene ditcher works.

bucket. The Osgood 200, ½-yd., with a 16′ boom and 7′ arm, will cut to 12′6″. The bucket is 30″ or 36″ wide.

No cost data are given on these backhoes, but the cost of ditching can be estimated rather closely on the basis of the initial cost price of the machine and local labor costs. Assuming a cost price of $10,000 and an overhead, as previously indicated, of 50% per year, including depreciation, interest, insurance, taxes, repairs and maintenance, and other costs, with a working year of 130 to 150 days, the overhead will be somewhere near $35 per day; adding to this the operation cost —labor, fuel, etc.—the actual cost will probably be in the neighborhood of $60 per day for a small shovel. Rented, such a unit will probably cost $75 or $80 per day. If it digs 500 feet of trench a day, the cost per ft. of trench will be 15 to 16 cents. Under good conditions, more than 500 ft. of trench per day is possible. The Schied Bantam Shovel is claimed to do 100 ft. per hour normally.



Cleveland wheel-type trencher action.

Boulders may slow down a trench hoe, but will not stop it. Rock excavation is not possible, without drilling and blasting. Therefore, special consideration must be given to estimating costs where rock is likely to be encountered.

The backhoes are probably less adaptable to digging in areas where there are pipes or other underground structures to which attention must be given to prevent damage. Most of the trenching machines previously described are equipped with sensitive devices for avoiding such damage, and are designed to cut close to a pipe without damaging it.

Trencher and backhoe speeds will vary between 1 and 8 ft. per minute, according to army experience. Use the lower figure for hard going and the highest figure only for optimum conditions.

Sewage Lift Station Explosion in Texas City

A sewage lift station explosion occurred in Texas City, Texas, during the recent holidays. An engineer of the State Department of Health visited the site on Jan. 13 and reported additional information which was forwarded to us by Dr. George W. Cox, State Health Officer, who wrote as follows:

"According to our engineer, firecrackers were dropped into the manhole of a lift station wet well. The explosion caused a concrete slab over both the wet and dry wells to rise several inches. As a result, the house, above the dry well, in which the pumps were contained collapsed. The pumps were put out of alignment and one of the sewer mains was broken at the station. At the time of our engineer's visit, reconstruction was practically completed with a frame structure replacing the tile house. The pumps had not been placed in operation and electrical connections had not been completed. The repairs to the building cost approximately $3500 and an additional $1000 will be required for necessary pump repairs.

"Undoubtedly the cause of the explosion was the presence of combustible sewer gases in the wet well and you may be further interested to learn that we are contemplating having our Industrial Hygiene Section make a study of many of the lift station installations in the Gulf Coastal area. We are quite aware that many of these installations are inadequately protected from trespassers or improperly vented and that further educational activities are necessitated. At our 29th Annual Short School held at College Station in 1947, one of our representatives spoke on the topic of sewage hazards and again this year at the 30th Annual Short School, another speaker discussed a similar subject and one which included safety in sewerage construction activities as well as occupational health hazards. In recent months, our engineers have made a total of six related addresses before district associations . . . and such activities will be continued."

Raising a Water Pipe

Work in Rankin Street and Fairfax Avenue, San Francisco, involved raising approximately 800 feet of 12″ water line and appurtenances, an average of five feet. After the pipe was exposed by excavation, it was raised to the required grade by means of slings supported by screw jacks bearing on gallows frames spanning the pipe trench. This work has been completed.

Work in Napoleon Street involves the raising of about 1690 lineal feet of 12″ pipe an average of three feet. After exposing the pipe by trenching, the contractor is raising it progressively in 6-inch lifts and backfilling with sand after each lift. A side-boom tractor and a tractor crane working alongside the trench furnish the lifting power.

Roads are kept clear in New Hampshire.

Ice Prevention In New Hampshire

LeROY F. JOHNSON
Maintenance Engineer

How road conditions are improved, even if the weather cannot be—a talk before the Highway Research Board.

TO provide pavements free of ice or frozen compacted snow during the winter months, it is our practice, on a 2-lane road, to spread ¼ lb. per sq. yd. of CC grade sodium chloride in a strip about 2 ft. wide along the center of the pavement, either as soon as one inch of snow has fallen (provided it compacts under traffic) or immediately after the snow plowing has been completed. Because it is spread without positive checks, the quantity will vary from 300 to 400 pounds per mile.

When spreading the chloride at the beginning of a snow storm, we must first know if the snow is compacting under traffic. If it does not, and traffic tends to blow it off the pavement, no chloride is spread, because this would make the snow adhere to the pavement. If it does compact, the chloride is spread.

Spreading the chloride at the beginning of the storm breaks up the compacted snow and makes it mealy, which permits the plows to remove most of it. If the storm is of sufficient duration to dissolve all of the chloride, an additional application must be made; and at the end of the storm there are usually some short sections that require further treatment. This general procedure is not especially effective with small volumes of traffic, as the chloride becomes buried by the snow, but is particularly useful on heavy traffic roads.

When to Apply

When sodium chloride is used following the storm, it is vitally necessary that it be spread as soon as the storm is over and the pavement has been plowed; provided the snow compacts under traffic. It has been our observation that at the conclusion of these storms the temperature remains above 20 Deg. F. for a short time. This period is generally of sufficient length to permit traffic to break up the snow mat and move it off the pavement.

With freezing rains, the sodium chloride is spread as soon as ice appears on the pavement. Generally one application of 300 to 400 pounds per mile is enough to dissolve existing ice, provide a bare pavement when the storm has passed, and permit emergency use of the highways with some degree of safety for motorists traveling at reasonable speeds.

Occasionally the temperature will fluctuate above and below freezing during one of these storms, and generally when the temperature rises above the freezing point, rain will fall more rapidly, thereby dissolving the chloride and making it necessary to repeat the application when the temperature drops below the freezing point and ice again begins to form.

Problems Encountered

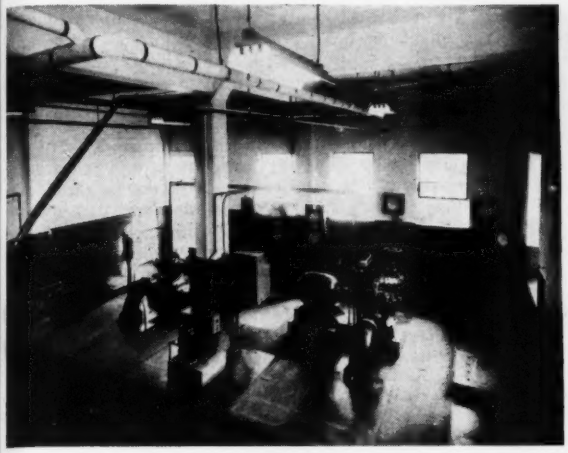
Although we believe we have had remarkable success with this method, there is one type of storm with which we have experienced difficulty. That is the storm when both sleet and rain fall together and deposit an inch or more of sleet on the pavement. Chloride spread at the beginning of these storms either becomes completely dissolved, or covered, so that no air can reach it and consequently becomes ineffective. The temperature drop to below freezing soon after the storm is over does not provide sufficient time to permit the pavement to be plowed and an ice sheet results. When this condition exists, we spread an application of calcium chloride followed by one of sodium chloride—the calcium chloride at the rate of 200 pounds per mile—the sodium chloride as previously described. This will generally cut through the ice layer and begin clearing the pavement.

Frequently we experience a storm during which the temperature will be above 30 Deg. F., when 12 to 18 inches of snow may fall. At these temperatures, the snow compacts under motor traffic and the plows cannot clear the pavement. Following this type of storm there generally is a gradual temperature drop to zero or lower, and these low temperatures sometime continue for two or more weeks with only occasional temperature rises when another snow storm arrives.

It was not unusual in the past to spread abrasives continuously for two or three weeks after such storms because a mat of snow was left on the pavement which became compacted and frozen. The snow storms which followed it came with much lower temperatures, and instead of being large moist flakes, were hard pellets which traffic would dust off the snow surface after the road was plowed. Now, one of these snow storms, with an accompanying temperature in the thirties, is generally cleared with one application since the chloride quickly penetrates

(Continued on page 38)

A close-up showing snow and ice control.



The new pump room is shown at the left, and the low dam and intake at the right.

New Filters Supplement Spring Supply

A spring supply that is inadequate at periods of heavy use is reinforced with a filtered surface supply.

R. F. TAYLOR
Assistant Engineer

THE water supply of Johnson City, Tenn., has been one of its outstanding features for many years, as attested by the fact that there are ten soft-drink bottling plants located in Johnson City, and using the municipal water supply in their operations. For many years we were able to draw an adequate supply from springs and underground collecting fields, which are located in a gravel formation in the watershed of North Indian Creek, about twelve miles from Johnson City. We have been able to get a very soft, clear, palatable water free from taste and odor, with a hardness of 30-32 ppm.; this water requires no treatment except chlorination. We have had the further advantage of a 100 per cent gravity system that required no pumping. The water flows by gravity from a central collecting well through a 16-inch cast iron pipe to distributing reservoirs having a total capacity of 5.5 million gallons.

The elevation of the overflow at the collecting well is 2,175 feet while the elevation of the distributing reservoirs is 1,838 feet. There are points on the supply line however that are as low as 1,700 feet. The supply line and much of the distribution system is constructed of Class "B" pipe with safety factors for pressure established by having the system open at both ends, with surplus flow at the springs passing to waste from the overflow at the collecting well, and surplus supply at the reservoir passing to waste at the reservoir overflow.

A view of the Johnson City filter plant.

The system serves a population of approximately 40,000 and is 98 per cent metered; on July 1, 1947, there were 7,100 metered consumers, an increase of 922 over the previous year. The maximum daily requirements as of July 1, 1947, ranged from 4.5 to 4.9 mgd.

35-Year-Old Line Has C = 140

It is most interesting and significant to note that the 16-inch cast iron supply main, which has been in operation for 35 years, has a Williams & Hazen coefficient of 140. The delivery capacity of this line is about 5,200,000 gallons per 24 hours. However, this supply has its volume limitations.

Meter records indicate that the maximum daily flow from the collecting wells is 4.8 mgd., this maximum flow occurring in the late winter and early spring when consumption is at a minimum, while the maximum daily flow during the summer months, at a period when consumption is high, is approximately 3.2 mg. It is readily apparent that the maximum demand and the minimum supply occur simultaneously. Johnson City, being faced with an increasing water shortage during the summer months after the maximum development of its underground water resources has been reached, was forced to seek an additional source of supply.

The nearest and most logical source of supply was North Indian Creek, which, at the point of intake, has a drainage area of 26 square miles. Gaugings and estimates indicated a mini-

mum flow during the summer months of 4,000,000 gallons daily, while studies of storage possibilities indicated an eventual development from this source to yield from 10 to 12 million gallons daily.

Developing a New Supply

The first step in the development of this program was the erection of a filter plant on North Indian Creek at a point approximately 2 miles from the spring supply collecting well and 125 feet below the well elevation. A low intake dam constructed on the creek provides for drawing off the water. This dam is equipped with Link Belt wooden wiers that may be raised to remove sand and debris that may have accumulated during or after periods of storm. A pump house equipped with two 1,750-gpm. low service pumps is located at this point, one pump being designed to serve as a spare under the present operating conditions.

The main filter plant is built approximately 500 feet from the creek at a point near the existing 16-inch main carrying the natural spring supply. A by-pass loop was cut into the main line and passes by the filter plant, at which point there is connected two 1,750-gpm. high service pumps; one of these also serves as a spare. Check valves at the pumps permit the continuous flow of the spring supply at times when the filter plant is not in operation.

During periods of minimum spring flow the head at the spring collecting well is very low and additional water pumped into the line at the filter plant builds this head up to its maximum which is the overflow point and is also the absolute capacity of the main under the present open-end system. The discharge from the high service pump is regulated to permit maximum flow from the underground source.

The New Plant

As the water passes the plant it is metered by two Builders-Providence venturi tubes; one on the high side of the pumps to measure the spring supply only, the other on the low side to measure the total spring supply and filtered water. A chlorine application point in the up-stream Venturi tube pit permits chlorination during periods the plant is not operating. When the plant is operating, chlorination is accomplished by chlorinating the filtered water sufficiently to obtain the desired chlorine residual in the finished water after the spring supply and the filtered water have become thoroughly mixed.

The filtration plant consists of one sedimentation basin 52 feet by 111 feet by 14 feet deep, with a theoretical settling period of six hours at a two-million gallon daily rate. A gravity mixing basin constructed at the inlet end of the settling basin is designed for a mixing period of 30 minutes.

As the water enters the plant it passes a Builders-Providence propeller type flow meter and a throttling valve is provided to regulate the flow. A short rapid mix is provided at the point where chemicals are added and the water then flows through a cast iron pipe to the mixing basin, then through the settling basin to the filters located inside the plant.

There are two filters, each having a capacity of one million gallons daily at a rate of two gallons per minute of sand area. The raw water is unpolluted and is generally low in turbidity, normally 8 to 12 ppm. An operating rate of three to four gallons per minute per square foot of sand area may therefore be used if required. The filters are equipped with Wheeler bottoms and use Anthrafilt as a filter media. The filters are operated by Iowa hydraulic valves and Builders-Providence controls.

The capacity of the system is limited to the capacity of the supply main, although some additional capacity may be obtained by the installation of booster pumps along the line.

The plant has been running satisfactorily on a part-time basis for 18 months with increasing length of operating time as the demand increases.

Wiedeman & Singleton of Atlanta, Georgia, designed the plant and supervised the construction.

N. H. Ice Prevention

(Continued from page 36)

the snow mat at these temperatures, and with the aid of traffic soon clears the pavement.

Before we used direct applications of sodium chloride, it was our practice to spread abrasives the entire length of the road along the center of the pavements. With this method of winter maintenance, approximately 175,000 cubic yards of sand were used on 2800 miles of highways each winter. Frequently, before these roads could be resanded, many areas would become slippery because of the quick movement of the abrasives from the pavement on curves and grades by passing vehicles. We now normally use about 40,000 cubic yards of abrasives on 3000 miles during a winter, largely to provide traction on grades before the pavements become bare, and during and after sleet storms. Our inability to obtain sufficient chloride, because of the lack of railroad shipping facilities last winter, resulted in our being required to use an additional 25,000 cubic yards of abrasives.

Ice prevention with this method has proven to be successful in New Hampshire for maintaining highways during the winter months. Ice prevention is a radical departure from the older practice of trying to skid-proof ice or frozen compacted snow with abrasives. Our experience during the past six winters has proven to us that the cost of using abrasives is greater than the cost of obtaining bare pavements through the use of sodium chloride.

However, because of the highway safety provided the motoring public by reason of bare pavements to drive on after each storm, we would continue to use chloride even though our cost might be greater.

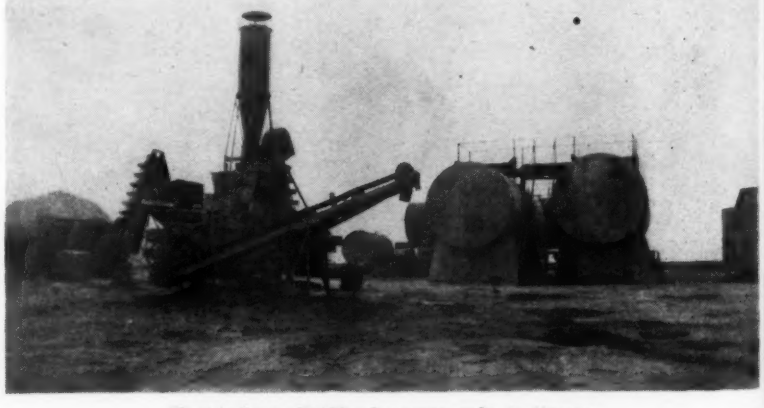
I believe it was Mark Twain who once remarked that everybody complains about the weather but nobody does anything about it. Although this is still true, we in New Hampshire are trying to do something about correcting the result of this weather insofar as it affects our winter highways.

Hot-Mix Paving With City Equipment

(Continued from page 31)

gutters and odd jobs, 1 man. Total, 15 men; also periodically, 1 man was used on the loader; and 3 men with trucks to remove the windrow from streets. Two men operate the gravel pump.

Several times during construction of this project and once after completion it was inspected by men with many years experience, who may be considered experts, with asphaltic pavements and they pronounced it a very good job. We sincerely hope they are right and that their opinion will be the same ten or fifteen years from now.



Plant and twin 10,000-gal. storage tanks, Ft. Morgan.

For Better Results from Trickling Filters

Use Vitrified Clay Filter Bottom Blocks

Save Costly Replacements

If the underdrain and ventilation system is not right, you cannot get the best results from a trickling filter. Once in operation it is hard or impossible to inspect the floor. It is costly to repair or replace it. So you will do well to use only the best. Use *Vitrified Clay Filter Bottom Blocks* made by members of the Trickling Filter Floor Institute.

These specially designed blocks have been specified by leading engineers for more than 20 years. They will not clog. They allow plenty of air to circulate through the filter medium while sewage flows down. For life-time durability, specify *Vitrified Clay Filter Bottom Blocks* on your next trickling filter. Write for new Trickling Filter Handbook.

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Bowerston, Ohio

When you need special information—consult the **ENGINEERS' LIBRARY** *on pages 77-80*

The tractor compacts the refuse dumped into the trench and compacts the dirt over the fill.

Special Wings on Bulldozers Help in Sanitary Fill Operation

INDUSTRIAL expansion and a 40,000 increase in population since 1942 has resulted in an extremely heavy tonnage of both industrial and domestic waste in Long Beach, California. This abnormal increase in the volume of refuse has forced Long Beach to revise its methods of waste disposal to prevent creation of an intolerable situation. Late in 1945 a large acreage, not far from the oil-famous Signal Hill section was set aside for a sanitary fill project. Under careful control, this has proved highly successful. Both domestic and industrial waste materials are disposed of quickly, in compact form, and with a minimum of complaint from nearby residents.

Procedure on the Fill

Procedure on the 23½-acre dump is relatively simple. A dragline excavator with a 5/8-yard bucket is assigned daily to dig a 50-foot length of trench 18 feet across by 6 feet deep. The excavated earth is dumped from the dragline bucket in uniformly spaced piles over (or reasonably close to) the refuse which was placed and compacted during the preceding day.

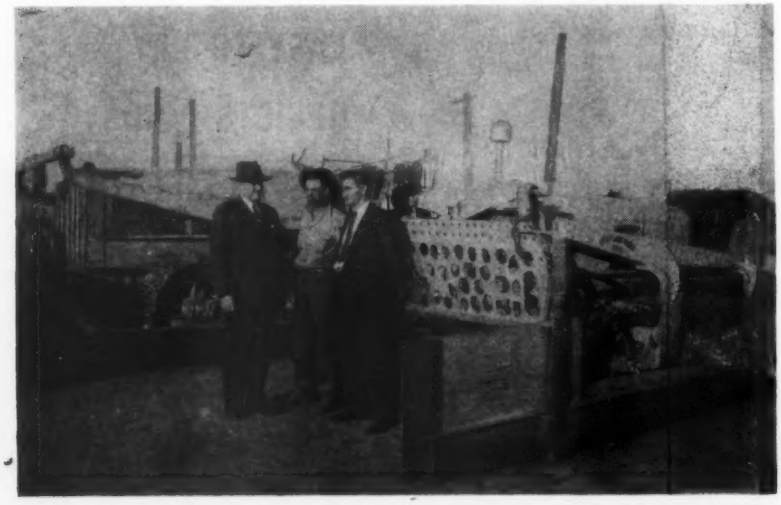
One of the city's three Allis-Chalmers tractors, either a Model L or a Model K is used to level and compact the earth on top of the already-compacted fill or refuse, and also to smooth and compact earth over the sloping bank of compacted refuse. This first earth cover is followed by a second earth cover which is spread and compacted in the same manner. The first earth cover is "tamped" down to about 18 inches thickness, while the second layer is only 12 inches thick when finished to what is almost equivalent to highway compaction and smoothness.

Refuse trucks, which haul 300 tons to the sanitary fill daily, dump their loads into the trench at the bottom of the fill. This is a marked departure from commonly followed methods in which refuse is dumped down over the bank from the top of the fill. Because there is, thus, no refuse-truck traffic on top of the hard, smooth fill, there is a complete absence of litter on the finished part of the project.

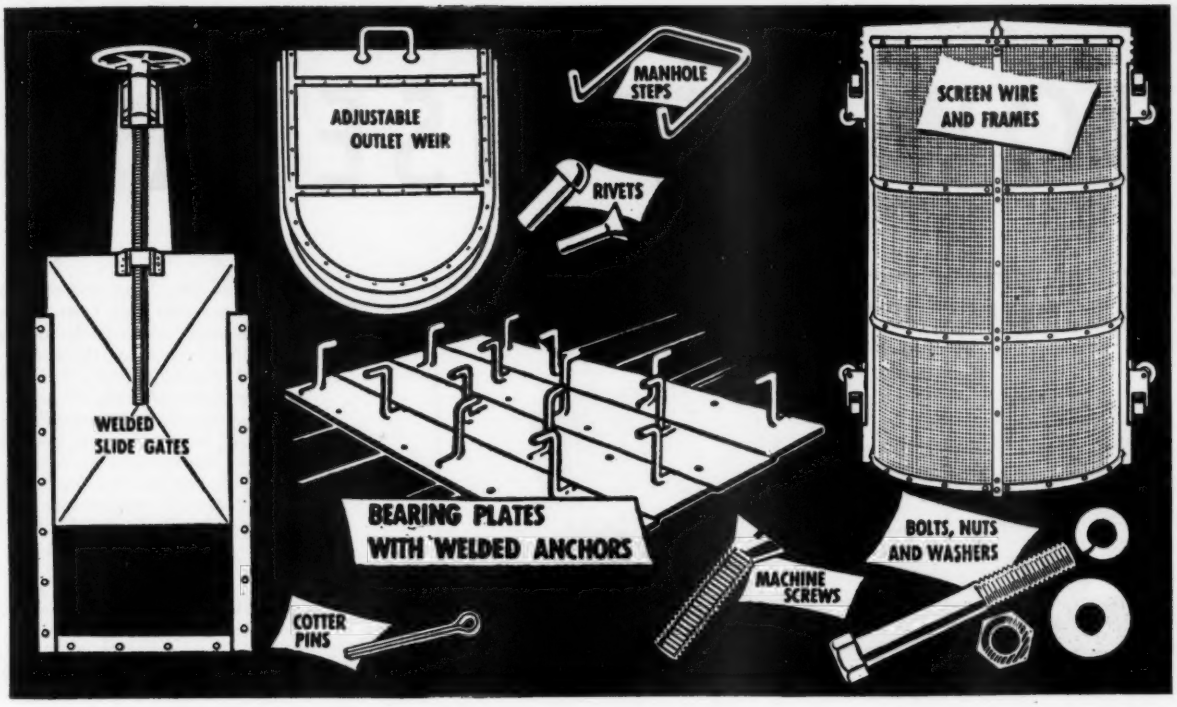
Burning Is Discouraged

From the bottom of the trench to the top of the finished, earth-covered fill, the distance, vertically, is 15 feet.

(Continued on page 52)



Left to right: Elmer Johnson, John Burns and Harry Linville. Side wing of tractor is shown at right.



If your sewage system handles industrial wastes... CONSIDER *Everdur*

SEWAGE SYSTEMS that handle industrial as well as domestic wastes need extra protection from corrosion. Everdur* Copper-Silicon Alloys are used extensively for this service.

For Everdur Alloys have excellent resistance to corrosion at all stages of sewage treatment operation. In addition, depending on the type or composition, Everdur Alloys may be worked hot or cold, have good machining properties and are readily formed, forged and welded. Everdur thus is readily adaptable to the fabrication of lightweight built-up equipment which offers exceptional durability and ease and economy of operation.

Consider specifying Everdur for such units as gates, screens, weirs, troughs, hoppers, orifices, conduit . . . even bolts, nuts and cotter pins wherever such small but important items are subject to corrosive influences. It can pay handsome dividends in trouble-free, long-term operations.

For more detailed information, write for Bulletins E-5 and E-11. 48182

*Reg. U. S. Pat. Off.

ANACONDA

Everdur

COPPER-SILICON ALLOYS

THE AMERICAN BRASS COMPANY

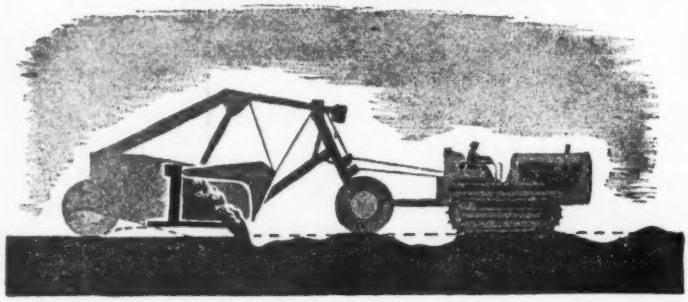
General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

HOW TO USE A SCR

METHOD OF FINISHING TO GRADE WITH SCRAPER BLADE



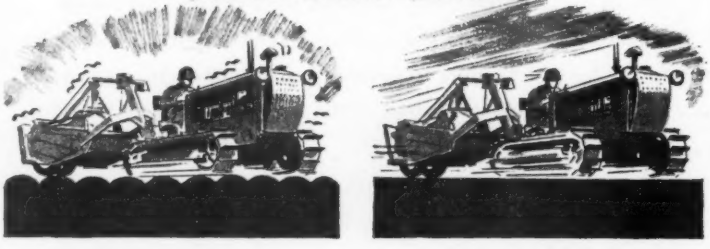
1. TRAVEL IN LOW GEAR
2. TAILGATE PULLED FORWARD APPROXIMATELY THREE-QUARTERS OF DISTANCE AND HELD IN THAT POSITION
3. BLADE SET TO CUT TO GRADE LINE
4. CUT AND FILL IN FORWARD TRAVEL. AS DIRT IS CUT IT PILES AGAINST TAILGATE AND DRIFTS INTO LOW SPOTS BELOW GRADE LINE

Courtesy OCE, WD, USA

Method of grading with scraper.

THE EFFECT OF ROUGH GROUND ON TRACTOR TRAVEL SPEEDS

(D7 TRACTOR–LS SCRAPER–1,000-FT HAUL)



ROUGH ROADWAY		SMOOTH ROADWAY
4 TH	TRACTOR GEAR–HAUL AND RETURN	5TH
4.6 MPH	TRACTOR TRAVEL AND SPEED	6 MPH
5 MIN.	TOTAL TRAVEL TIME–1,000 FT. HAUL	3.8 MIN
8	TOTAL TRIPS PER HOUR	9.5
75 CU YD	CU YD EXCAVATION PER HOUR	90 CU YD

SUMMARY

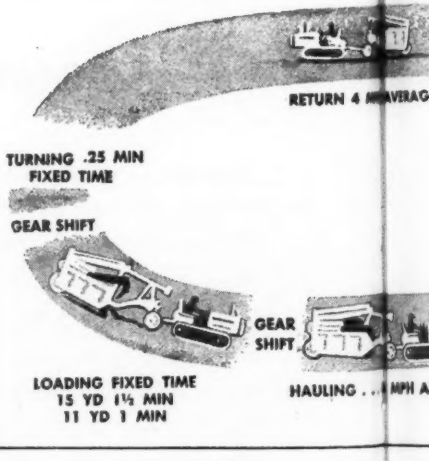
SMOOTH ROADWAY PERMITTING TRAVEL BOTH WAYS IN 5TH GEAR ADDS 15 CU YD PER HR OR 120 CU YD PER 8-HR SHIFT

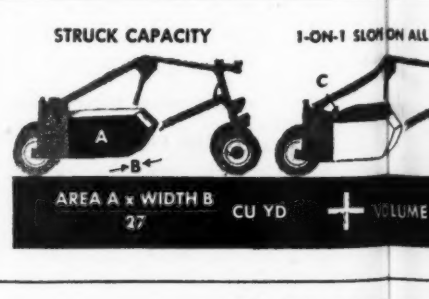
Courtesy OCE, WD, USA

Effect of poor haul roads on efficiency.

FOR hauling large volumes of earth between 300 and 1500 feet tractor drawn scrapers generally out-perform any other type of earth-moving equipment. Observation of a few rules will greatly increase scraper performance. Loading should be accomplished on a downhill run wherever possible. Increased yardage can be obtained by leaving a center strip, one-half blade width, on two successive cuts and "straddle loading" on the third trip. Under average conditions, the load should be obtained in less than 100 feet of travel and in one minute or less, while spreading should take no more than ½ minute. Where heavy soils are encountered a pusher tractor kept at the loading site to aid the digging operation will increase efficiency. On the haul the operator should maintain the maximum possible speed, using highest gear. Turns should not

Below: Typi scraper





Determining heaped capaci

SCRAPER

...es of earth
...feet tractor
...out-perform
...ving equip.
...v rules will
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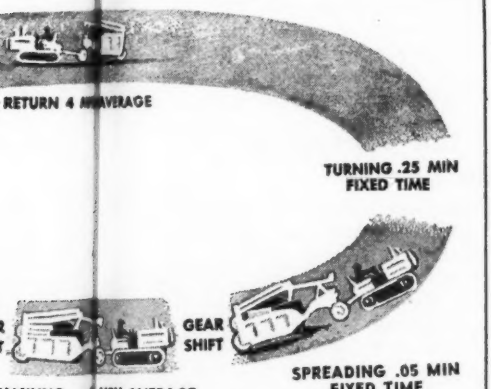
...lished on a
...ssible. In-
...btained by
...-half blade
...cuts and
...third trip.
...the load
...than 100
...minute or
...d take no
...ere heavy
...er tractor
...d the dig-
...efficiency.
...uld main-
...le speed,
...hould not

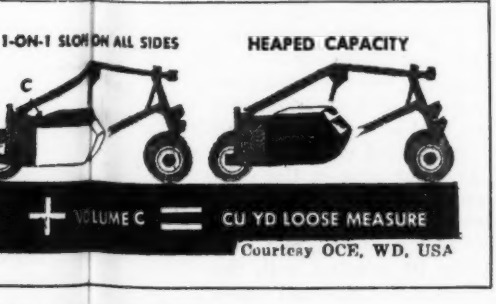
take over 15 seconds. Proper maintenance of the roadway over which scrapers travel will add greatly to output.

The output of a scraper operating in a regular cycle such as that shown below can be readily computed. Assume that the heaped capacity of the scaper is 11 cu. yd. and that the scraper will operate 80% of the time. Further, it is known that a yard of loose material in the scraper bowl is equivalent to only .72 "in-place" or compacted yards. If the haul each way is 600 feet and speed averages 4 mph, travel time equals 3.4 minutes per cycle. Adding 1 minute for loading, ½ minute for spreading, ½ minute for two turns and ½ minute for gear shifts the total cycle time is 5.9 minutes. Allowing for operation 80% of the time, output per hour equals 11 x 0.72 x 60 x 0.80, divided by 5.9 or 64 cu. yd. per hour.

Below: Typi... scraper cycle.



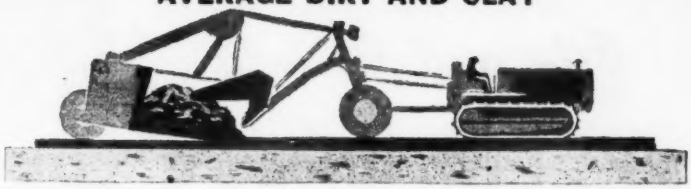
Courtesy OCE. WD, USA



Courtesy OCE, WD, USA

...ing heaped capacity of scraper.

AVERAGE DIRT AND CLAY



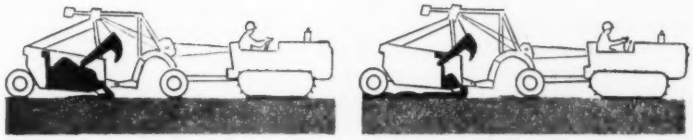
1 RAISE APRON JUST HIGH ENOUGH SO MATERIAL WILL NOT PILE AHEAD OF APRON
2 REGULATE BLADE TO MAINTAIN STEADY FORWARD TRAVEL AT FULL ENGINE RPM

SAND

1 START LOADING WITH APRON COMPLETELY RAISED
2 CONTINUE UNTIL SAND PILES UP IN FRONT OF BLADE
3 RELEASE APRON CABLE SO APRON RESTS ON PILE AT FRONT
4 RAISE AND LOWER BLADE WHILE TRAVELING TO PUMP SAND INTO BOWL
5 REPEAT PUMPING ACTION UNTIL HEAPING LOAD IS OBTAINED

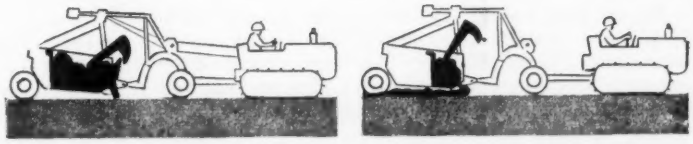
Courtesy OCE, WD, USA

SPREADING AVERAGE DIRT AND SAND



1 SET BLADE HIGH ENOUGH TO ALLOW MATERIAL TO PASS UNDER BLADE
2 RAISE APRON . . . STICKY MATERIAL WILL NOT FALL FROM APRON
3 DO NOT FORCE TAILGATE FORWARD UNTIL MATERIAL IS LOOSENED FROM APRON
4 PULL TAILGATE FORWARD FAST ENOUGH TO EJECT MATERIAL IN STEADY FLOW AND MAINTAIN EVEN DEPTH OF SPREAD
5 BEST SPREADING RESULTS OBTAINED TRAVELING IN 1ST OR 2ND GEAR

EJECTING STICKY MATERIALS



1 SET BLADE FOR REQUIRED DEPTH OF SPREAD, ACCORDING TO TYPE OF MATERIAL USUALLY 6 TO 8 INCHES
2 RAISE APRON, ALLOW EXCESS MATERIAL TO FALL AWAY BEFORE PULLING TAILGATE FORWARD
3 TRAVEL FORWARD . . . DIRT PASSES UNDER BLADE
4 RAISE AND LOWER APRON TO LOOSEN MATERIAL IN FRONT OF BOWL
5 PULL TAILGATE FORWARD AND CONTINUE APRON ACTION
6 SOME MATERIALS CAN BE LOOSENED BY PULLING TAILGATE FORWARD, THEN RETURNING A SHORT DISTANCE

Courtesy OCE, WD, USA

Loading and spreading various types of soil.

City and County PUBLIC WORKS *Engineering Data*

New Pump Saves Money at Pasadena

During the fiscal year ending June 30, 1947, the Pasadena, Calif., Water Department installed a new 200 hp. electrically driven deep well turbine pump at the Sunset Plant to replace a unit in service since 1924. The overall efficiency of this new unit is 75.7%, as compared to 62.3% for the old one, and the saving in power will be $1570 a year.

Land-Slide Correction Method

Corrective measures were taken by the City of San Francisco at the old slide area on the west of Bernel cut, between Miguel St. and St. Mary's Ave., where private property was being endangered. The slide area was excavated in a series of benches, subsurface drainage was installed, and the excavated area re-filled with quarry rock to the general slope lines of the adjacent undisturbed ground. To prevent dislodgement of the rock and to seal the surface a two-inch coat of gunite was applied to the rock slope. To harmonize the treated slope area with the adjoining undisturbed ground surface, the gunite was colored by the addition of two pounds of brown iron oxide to each sack of cement used. This procedure proved very satisfactory. This treatment of the slide was adopted as a substitute for a much more costly retaining wall.

Preventing Poison Oak Dermatitis

Poison oak, poison ivy and poison sumac have long been hazards to construction workers and surveyors. The U. S. Navy has been experimenting with ascorbic acid as a cure and a preventive. A recent issue of the Navy Medical News Letter states, in part, as follows:

In the determination of prophylaxis against poison oak dermatitis, two groups of men (24 in each group) who were sensitive to the plant were tested. Each group was divided into two sections, 12 men in each section. During the period of exposure to poison oak, those in one section took the prescribed prophylatic dose of ascorbic acid and those in the other did not. Those who took the prophylactic dose of ascorbic acid did not contract the disease when exposed, but a large percentage of those who were not given the daily dose of ascorbic acid did contract poison oak dermatitis, ranging from mild to severe. The dose which is felt to be adequate for protection ranges from 150 to 300 mg. daily and can be taken in tablet form in divided doses. This daily dose must be taken one day prior to exposure, every day during exposure, and at least from 24 to 48 hours after exposure.

Despite the small number of patients treated and the diverse intensity of the reactions of different persons susceptible to the poison of Toxicodendron and to treatment, which make it difficult for reaching concise conclusions, it is nevertheless felt that ascorbic acid is an effective therapeutic agent and has definite possibilities as a preventive. (Arch. Dermat. and Syph., Dec. '47—D. H. Klasson.)

Main entrance to the University of Chile, at Santiago, location of Inter-American Sanitary Engineering Congress (see page 30).

DDT Dusting in the Control of Rat-Borne Typhus

A program involving the application of 10% DDT dust to rat runs, burrows, and harborages in an attempt to control human murine typhus fever cases by reducing rat fleas and other rat ectoparasites was initiated by the U. S. Public Health Service in 9 southeastern states. A few dusting projects were established in July 1945; by March 1946 the full program was in operation. Projects were operated by 122 of the highest typhus-reporting counties in the 9 states during the entire calendar year 1946 and the first half of 1947. These counties in 1944 accounted for 72.3 per cent of all typhus reported in the 9 states or 70.5 per cent of all typhus reported in the entire United States. The remaining 460 counties in these states had no regular DDT dusting program.

Although not much reduction was expected during the organizational period of July-December 1945, a decrease of 10.7 per cent in reported typhus occurred for the year in the dusted counties compared to an increase of 14.5 per cent in the non-dusted counties, a differential of 25.2 per cent. A greater differential occurred in 1946 and continued in the first half of 1947, 44.1 per cent and 56.4 per cent respectively. In the 10 counties with the highest incidence of typhus, the reported cases decreased from 1,074 in 1944 to 395 in 1946 and,

Engineering Facts about

Johns-Manville TRANSITE PRESSURE PIPE

*Winnipeg: A case history**

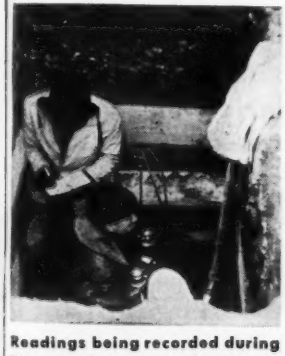
IN 1932 the city of Winnipeg, Manitoba, made its initial installation of Transite Pressure Pipe. A portion of the installation consisted of an 18" line. Recently this pipe was subjected to a series of field and laboratory tests to determine its condition after 14 years of service, which had included exposure to an extremely corrosive soil.

Pitometer Flow Test

Before the pipe was removed from the line for the laboratory tests which were to follow, its flow capacity was checked. The Pitometer Company, Inc., New York, was selected to conduct these field tests. Velocities ranged from 1.1 to 1.9 feet per second and readings were made at 30-second intervals. During each test, the velocity was held constant. Results were summarized by the Pitometer Company as follows:

Assembly of pipe and coupling being removed from the line for laboratory tests.

"The high value of C-140, which we believe is a reliable index of the present capacity of the pipe tested, shows that there has been little if any loss in capacity since 1932 when the pipe was laid."



Readings being recorded during Pitometer flow tests on the line.

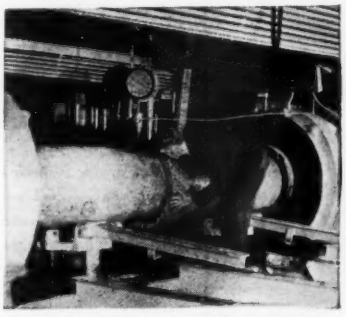
Soil Conditions

The soil in which this Transite installation was made was known to be destructive to water pipe. Analysis showed the presence of certain soluble salts, which, when dissolved by ground water, became highly corrosive.

It was desired, therefore, to determine how well the Transite line had withstood these severely corrosive conditions and thereby to provide a basis for gauging its life expectancy. To do this, a series of physical tests were made, using the sections of pipe which had been removed from the line for the purpose. The most significant of the tests conducted on the pipe were the hydrostatic pressure tests.

Hydrostatic Pressure Tests

In order to simulate field conditions as closely as possible, an assembly consisting of portions of two lengths of pipe joined by a Simplex Coupling with rubber rings and sleeve intact was tested. The complete assembly was placed in a hydrostatic testing machine and the water pressure was raised to 260 pounds per square inch. This was the original test pressure to which this pipe had been subjected at the factory and 4 times the normal working pressure of the line.



Assembly of pipe and coupling undergoing hydrostatic pressure test.

Pressure was held at 260 pounds while observers closely examined the coupling for leakage. No leakage occurred. The rubber rings, undisturbed and in their original position, functioned as well as when the pipe had been placed in service 14 years previously. Subsequent careful inspection and tests confirmed that the rubber rings removed from this Transite line were free from any signs of deterioration.

Specimens of the Winnipeg pipe were also subjected to other laboratory tests. Crushing tests showed that its strength compared favorably with that of Transite Pressure Pipe as manufactured today. A corporation stop pull-out test provided further verification that the strength of this pipe was in no way impaired.

Summary

The above series of tests provided conclusive evidence that the strength, flow capacity and other physical characteristics of the Winnipeg pipe were unimpaired after 14 years' service under severe conditions. Further, as summarized in the original report, they demonstrated that "on the basis of the performance rendered to date, it is reasonable to anticipate a life-expectancy of many times that already obtained."

* *A copy of the detailed performance report on this Transite Pipe installation is available on request. Address Johns-Manville, Box 290, New York 16, N. Y.*

JOHNS-MANVILLE JM PRODUCTS

in several cases, DDT dusting was the only control measure being applied. Reduction of *Xenopsylla cheopis*, the Oriental rat flea, averaged 84 per cent in the treated areas on the basis of actual flea counts from over 17,000 live rats. (Pub. Health Reps., Jan. 9, 1948.)

Contractors in Highway Construction

The number of contractors bidding on Federal-aid highways has not exceeded 3,676 in recent years. A. C. Clark, Chief of the Division of Construction of the Public Roads Administration, stated in a paper before the recent ARBA meeting that during the period from 1935 to December 31, 1947, a total of 6,121 contractors performed work on Federal-aid highway construction. From January 1, 1940, to December 31, 1947, there was a total of only 3,676 contractors. This indicates a net mortality of some 2,445 contractors who previously performed work during the period 1935 to 1939, or approximately 40 percent. Many of these contractors went into war work and other types of industry and many of them are reluctant to re-enter the highway field because of present unsettled conditions relating to materials and labor and inability to secure equipment. The number of contractors now performing Federal-aid highway work, however, includes 858 new contractors and 112 contractors who bid previous to 1940 and who have re-entered the field. In addition there are approximately 250 new contractors that have been bidding unsuccessfully in recent months and this number constitutes a potential source of additional competition. In regard to actual competition during the past year, there was an average of 3.8 bids per project throughout the country ranging from 1.2 in New York, to 8.2 in Georgia. On 236 projects no bids at all were received.

As an indication of the possibility that many contractors may be overloaded with work, it was found that 27% of all going projects show an unsatisfactory rate of progress ranging up to over 50% in some States. The unsatisfactory progress is attributed to the following main factors: Lack of efficiency in contractors' organization, 31%; lack of equipment and repairs, 18%; lack of materials, 18%; lack of labor, 15%; weather and miscellaneous causes, 18%.

Concreting Experiences in San Francisco

Concrete specifications for curbs and parking strips on Guerrero Street, San Francisco, called for the use of "one-day cement" to permit prompt access to garages along the line of the improvement. In lieu of "one-day cement," which was not available, calcium chloride was authorized at the rate of two pounds per sack of cement. This admixture worked very satisfactorily and the concrete set rapidly enough to permit automobiles on the parking strip within twenty-four hours.

Calcium chloride was also used in the Class "A" concrete for the precast piles for the Vicente Street outfall sewer. Driving was permitted when the concrete attained a strength of 3500 lbs. psi., which was found to require only five days. The calcium chloride originally was added at the central mixing plant but, due to the long haul and the moisture in the aggregates and sand, the concrete set too

fast for the finishers. This was remedied by adding the calcium chloride after the truck reached the job and mixing just before pouring.

Transit mix, using Class "E" concrete with 3-inch maximum aggregate, was tried on Clipper Street. A little difficulty was at first experienced in keeping the mix to a uniform slump and a few loads arrived at the job too stiff. After the first day's run, the control was satisfactory and very little trouble was experienced thereafter.

In spite of the cold winds blowing at the time, the finished pavement did not develop any surface cracks. This was probably due to the dissipation of the heat of reaction in transit, resulting in a cooler mix in place as compared with the warmer mix and the continued reaction heating which occur when mixing is done on the job.

Costs of Drainage Project Must Not Exceed the Benefits

In Indiana one of the three tests which must be found in favor of the petitioners for the establishment of a drain before the viewers can report favorably on the project is that the costs must not exceed the benefits. Where a petition was filed for the establishment of a drain, the engineer made a report setting forth an estimate of benefits and damages and the viewers found that the benefits would exceed the costs of the project. Remonstrances were filed with the engineer's report. A judgment of the trial court modified the report in part only. The viewers found that the benefits would exceed the cost of the project. The remonstrators appealed, but as the viewers' report as to benefits exceeding costs was not attacked in the lower court, the ruling on that point could not be raised on appeal and the judgment was affirmed. Campbell v. Accord, Indiana Supreme Court, 72 N.E. 37.

Preparing Concrete Pavement for Patching

Arkansas has a considerable mileage of concrete pavement which has broken in places due to pumping action at joints. To repair these breaks, the damaged area is removed. The boundaries of the area to be broken out are marked with a concrete saw having a diamond edged circular blade, either 10- or 12-in. in diameter, driven by a 6-hp. gasoline engine.

A kerf averaging 2 in. in depth is cut around the area to be removed at a rate of approximately one lineal ft. per min. Only one man is required for this operation. After the limits of the patch have been defined, a self-propelled pneumatic paving breaker, mounted on a tricycle chassis is used. This machine has a 600-lb. hammer with an impact of 3,000 to 3,500 lbs., which rapidly breaks up the concrete into fragments of any desired size. An air compressor and hammer unit, mounted on a truck, completes the job. Only one man is required for operation as the breaker is coupled to the truck and towed from one location to another.

By using these two pieces of equipment, almost all spalling beyond the limits of the cut is eliminated and a much better construction joint between the new and old concrete is obtained. Results have been so satisfactory that more units of this equipment are being acquired. *The Military Engineer and Highway Research Board.*

PUBLIC WORKS DIGESTS

Sewerage

Water Supply

Highways and Airports

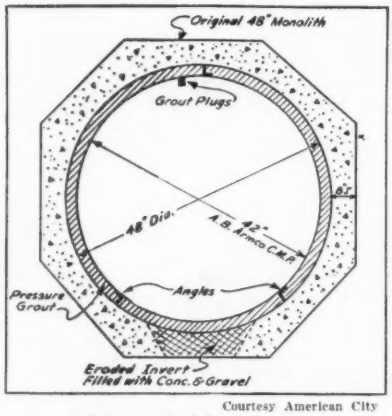
This section digests and briefs the important articles appearing in the periodicals that reached this office prior to the 15th of the previous month. Appended are Bibliographies of the principal articles, in which the articles in each periodical are numbered consecutively throughout the year, beginning with our January issue.

The letter and number at the end of each item refer to those used in the Bibliography. Numbers not found in the current Bibliography will be found in the one published the previous month.

The Sewerage Digest

Relining a Four-Foot Sewer

A 48" concrete storm sewer at Waukegan, Ill., built in 1929, carries wastes from industries, some of which began to disintegrate the concrete about 1941. By 1945 the invert of a 300-ft. length was completely destroyed for a width of about 15", and the velocity of the sewage, about 15 fps, threatened to undermine the whole structure. To repair this length, the eroded invert was filled with grouted stone and then a 42" Armco asbestos-bonded pipe, bituminous coated and having a paved invert, with water-tight joints, was pulled through the old sewer. Threaded and plugged openings had been provided at intervals along the top of the pipe, and after the pipe was in place grout was pumped through these to fill the space between the old sewer and the lining. This has been in use for two years and no deterioration is apparent.[J5]



Courtesy American City

Relining method for 4-ft. sewer.

Composting in New Zealand

Dannevirke and several other New Zealand boroughs dispose of their household refuse by dumping in layers covered with 2" to 6" of earth or sawdust; the latter being preferable when the material was to be used as a fertilizer. Lately it has been proposed to compost the city's 70 tons of sewage sludge and 250 tons of refuse per year at an estimated cost of about $3,300 (including cost of collecting), the product being salable at $16 a ton, giving a profit of $700. The borough engineer recommends this system for both large and small towns.[T1]

Enlarging Plant At Madison, Wis.

Madison expects to award contracts this year for increasing the capacity of its present treatment plant, which will include some unusual features. There will be flocculation tanks between the grit chamber and the aeration plant to freshen the sewage, create aerobic conditions and an environment favorable to secondary treatment organisms, and improve grease separation and solids removal in the primary tanks. Waste activated sludge may be introduced into the flocculation tanks to provide nuclei for floc formation.

Both primary and final settling tanks will have effluent troughs located some distance inside the tank wall, which will greatly increase the weir length and be out of the zone of density current upturn. This is expected to reduce the suspended solids and BOD in the effluent. The depth of the aeration tanks is to be increased without increasing the blower pressure by using swing diffusers located 2 ft. above the bottom.

It is planned to improve sludge digestion by use of external heat exchangers, using jacket water from the engine driven blower for heating the raw sludge, which will at the same time be seeded by mixing digesting sludge with it. Vacuum filters will be used to eliminate the need for sludge storage and nuisance from lagoons, permitting use of existing storage tanks for primary digestion. Elutriation tanks are expected to reduce materially the chemical dosage for sludge conditioning prior to vacuum filtration.[G7]

Industrial Wastes in Los Angeles County

Laws of Los Angeles County, Calif., provide that wastes must not create a public nuisance, or be a menace to public health and safety; if discharged into natural or artificial drains or streams or onto land, they must not contaminate or pollute the underground waters; if discharged into public sewers, they must not damage the sewers or unreasonably increase costs of maintenance and operation of them, nor disrupt operation of sewage treatment plants. Industries generally have been most cooperative and most violations of these regulations have been unintentional.

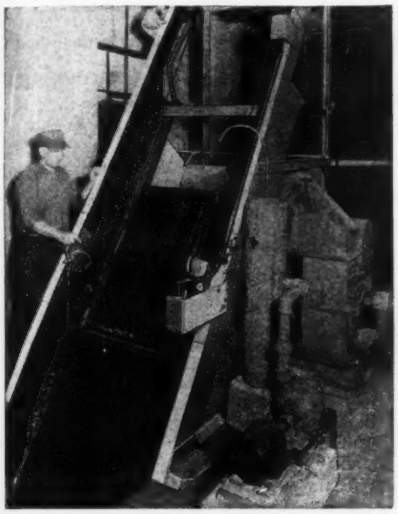
Garbage and refuse from canning and freezing plants amount to several score tons a day. One plant discards 30 tons of waste spinach leaves a day during the spinach season, and 1000 gpm of waste water. Many plants grind the solids and discharge them into the sewer.[G8]

Refuse Containers In Richmond, Va.

A few months ago Richmond began a new method of collecting refuse from stores and other large producers, using steel boxes 6 x 8 ft. by 6 ft. long, bottom dump, into which the refuse is placed directly by the producers of it. They are removed by a truck designed especially for the purpose and emptied on dumps operated by the land-fill method. The producers of refuse have purchased 85 of these boxes at about $300 each, and the city services them

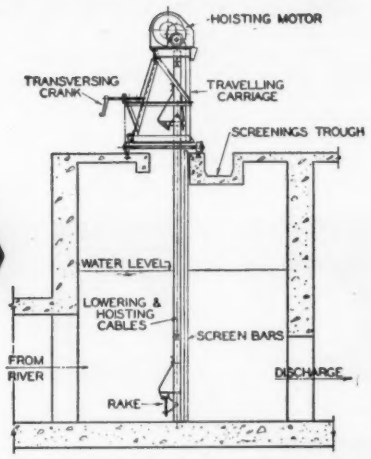
IS SCREENING LIQUIDS *YOUR PROBLEM?*

Link-Belt sanitary equipment engineers with their vast experience in screening liquids, are prepared to help you with your particular problems, and to recommend and supply the correct type, of coarse, medium or fine screen. Write or call our nearest branch office for detailed information on any of the following types of screens:



TRASH SCREENS

—for the removal of large floating particles from large volumes of water, for the protection of fine water screens or other water plant or power plant equipment.



TRASH SCREEN WITH MECHANICAL RAKE

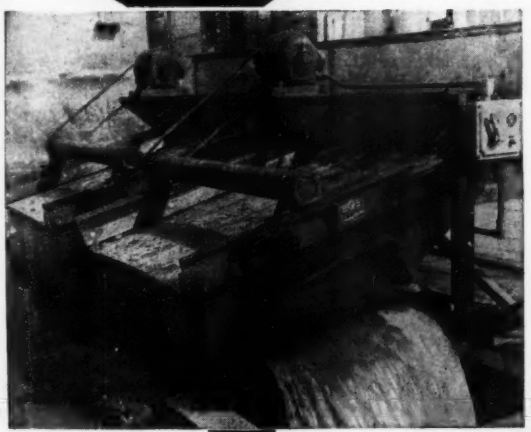
STRAIGHTLINE SCREENS

—for the removal of solids over ½ inch size from sewage or industrial liquids.

TRITOR SCREENS

—for the removal of both grit and floating solids or other detritus from waste waters.

VIBRATING SCREENS



—for the removal of fine solids from industrial liquids.

In addition to screens, Link-Belt Company manufactures a complete line of equipment for water, sewage and industrial waste treatment such as Straightline and Circuline sludge collectors, grit collectors and washers, mixers, scum breakers, aerators, dryers, power transmitting, elevating and conveying machinery. Send for catalogs.

LINK-BELT COMPANY

Chicago 9, Indianapolis 6, Philadelphia 40, Atlanta, Dallas 1, Minneapolis 5, San Francisco 24, Los Angeles 33, Seattle 4, Toronto 8.
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with four trucks costing about $6,000 each. The cost, including labor, operation, maintenance, depreciation and overhead, has averaged 38 cts. per cu. yd.; while by the old small container method the cost averaged 99 cts.[E11]

Industrial Uses Of Sewage Effluents

It probably will in time be found more attractive financially to salvage the water in sewage than its solid contents, although at present the use of sewage treatment effluents for industrial purposes is limited to a few instances where an adequate supply from ordinary sources is either very expensive or actually not available. To make such use worthy of consideration, there must be a local industry needing the water, a sewage plant that can furnish the amount needed; and the cost of furnishing the supply, processed if necessary, must be less than that from other sources.

Data collected by the author show use of sewage effluents at 135 locations in 18 states; for agriculture at 124 places, oil refining at 9, steel production at 2, railroads 2, and one each by a municipal incinerator, mining, and a skating rink. In one case a railroad paid, for use as boiler water, the entire cost of sewage treatment for the community; in another, an oil company paid 90% of the cost of sewage disposal.[C12]

Charging Incinerators

The use of floor-dump storage and feeding of incinerators creates unsightly and unsanitary conditions and adds to labor costs; but the use of pit and bridge crane is too expensive for any but large plants. For small plants the author recommends the use of a painted, washable pit from which the refuse is handled mechanically by a monorail crane. This permits feeding the refuse at a uniform rate, and the pit furnishes sanitary storage for occasional peak loads or late afternoon deliveries; but the pit should be cleaned out and washed at least every other day. By this method both head room and floor area can be made less than is necessary with the floor-dump method, this saving in construction cost tending to balance the cost of the refuse handling mechanism.[E9]

Agricultural Use of Effluents

Certain inorganic salts, contributed to sewage by some trade wastes, are toxic to plants. These salts include aluminum, lead arsenate, chromium in some forms, cobalt, copper, manganese, mercury, thallium and zinc. Effluents of this type can often be used for irrigation if diluted sufficiently with good water.

In experiments conducted recently in Phoenix, Arizona, mixtures of dilute digested sludge and ferrous sulfate were added to poor alkaline soil and are showing marked stimulation of plant growth. The beneficial effect of favorable constituents of sewage effluents, particularly when treated with ocidic iron sulfate, may throw the balance in favor of such effluents as compared to ordinary irrigation water.[O15]

Industrial Use Of Baltimore's Effluent

The Bethlehem Steel Co. which, in a plant near Baltimore, Md., makes all kinds of steel articles from nails to ships, in 1941 contracted with that city to take up to 50 mgd of effluent from its activated sludge and trickling filter plants; and in 1947 contracted for 100 mgd or less. The activated sludge plant furnishes 10 to 15 mgd of effluent, all of which the company uses and supplements with filter effluent which it treats further by alum coagulation and precipitation. Both effluents are chlorinated to prevent accumulation of slime in the pipe that carries them to the company's works. The effluents are stored in a 70 mg reservoir, where algae have given some trouble but are kept in check by means of chlorine and copper sulfate. The company has spent over $2,000,000 for the plant for securing and treating this supply.

The city contracts to "make every practicable effort" to deliver an effluent from the activated sludge plant with a

pH between 6.5 and 7.8; with suspended solids not exceeding a momentary maximum of 50 ppm or a monthly average of 25 ppm; a BOD not exceeding a maximum of 45 ppm or a monthly average of 25 ppm; and not over 175 ppm of chloride content. Also to furnish an effluent from the trickling filters similar to the above except that the suspended solids and BOD are limited to 80 ppm maximum, and the monthly averages to 50 ppm and 40 ppm respectively.[C14]

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Dow Movie Shows How Weeds Are Killed

By Lyne S. Metcalf

Dow Chemical Co., Midland, Mich., has available a 16 mm. sound motion picture, in natural colors, on weed control. The title is "Death to Weeds." By means of motion photography and animated technical drawings, weeds are identified and methods of elimination are shown. Weeds covered in this presentation include: Dandelions, plantain; wild mustard; thistle; tule; arrowhead; lily; pigweed; curly dock; bitterweed; bindweed; water hyacinth; poison ivy; sassafras and sumac. For free loan of this movie write to Millard Hooker at the above address.

Sanitary Fill Operation

(Continued from page 40)

This provides for a vertical depth of 12½ feet of compacted refuse, since the total compacted earth cover is 2½ feet thick. Double covering and compacting with earth to this thickness results in complete lack of unpleasant odor. No burning is permitted, and the rare accidental fires are extinguished immediately. This, with thorough compaction of the refuse in thin layers, contributes to gradual, even settlement and eliminates the smoke nuisance associated with ordinary dumps.

Depositing of refuse in the trench at the foot of the fill means that the material must be shoved uphill by the tractors and their bulldozers. This, too, has advantages, as the material is thus run over and compacted time and again by the tractor treads as they climb up and down the bank. In fills where trucks dump at or over the edge of the bank, there is no opportunity to compact relatively thin layers of material, for the tractors, in such cases, can seldom venture down the slope. At the Long Beach fill, the tractors are continually running back and forth in the trench, reducing the volume of waste material so as to fill a minimum space and reduce future settlement.

Of the three Allis-Chalmers tractors owned by the City of Long Beach, the Model L and the Model K are worked

Unsatisfactory method of covering an open dump without compaction of refuse.

VITRIFIED CLAY PIPE

Replaces Detroit Disintegrated Sewer

Municipal engineers are not crystal gazers—they can't look into the future and foresee what types of industry will spring up in their communities. In many cases, city engineers have found that sewerage and drainage lines, adequate when installed, could not withstand the deteriorating action of waste materials originating in the plants of new industries.

City of Detroit engineers were recently confronted with this problem of replacing worn-out sewerage lines. Vitrified Clay Pipe was specified because it is the only pipe able to withstand the damaging effects of waste matter originating in the lines of one of Detroit's principal industries. Clay Pipe's immunity to corrosion, rust and deterioration is the big reason more and more industrial, municipal and consulting engineers are making long-lasting Vitrified Clay Pipe a "must" in their specifications . . . for Clay Pipe resists successfully the action of chemicals, corrosive materials, alkalies, ground and sewage acids. Engineers know that

Tunneling was necessary on the Detroit municipal lines, using 27-inch and 30-inch Vitrified Clay Pipe. Ray D. Baker, contractor, handled the job with T. F. Forrest acting as construction superintendent. George R. Thompson was City Engineer.

there is not one single instance on record where Vitrified Clay Pipe has ever worn out!

If you need specific information on Clay Pipe, write the details to the office nearest you.

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C-348-3

Vitrified CLAY PIPE

constantly on the sanitary fill. The HD-10 is a sort of freelance, and is dispatched to various sections of the city on all kinds of pushing, pulling and hauling jobs when not needed on the fill.

Special Attachments for Handling Refuse

The bulldozer blade on the K tractor has a side wing at the left front, extending some 3 feet beyond the blade. This device, designed by the city's Automotive Department, is found to be extremely effective in keeping light material from spilling off the end of the blade on the uphill side of travel. Tractors travel with the top of the bank at the operator's left, and the lefthand side wing prevents loose-piling or ridging which would later require extra travel to compact.

The bulldozer on the L tractor has a somewhat shorter side wing on each side of the blade, serving much the same purpose, but not quite as effectively as the longer side wing on the Model K.

B. H. (Harry) Linville, Superintendent of the Automotive Department, City of Long Beach, says that the gasoline-powered Model L Allis-Chalmers tractor uses about 35 gallons of fuel in an average 8-hour day; the Model K, also a gasoline-powered machine, uses about 25 gallons; and the Diesel-powered HD-10 uses 25 gallons of Diesel fuel. Linville's department is the official owner of all automotive equipment of the City of Long Beach, except for the Fire and Water Departments. Included in his care is the automotive equipment used by the Sanitary Division of the Public Service Department (which takes in the tractors on the sanitary fill) and the equipment used by the Police, Health and Street Departments. This centralization of responsibility results in excellent maintenance efficiency and, equally important, the elimination of considerable needless duplication of equipment.

John Burns, foreman of the Long Beach sanitary fill, states that 12 of the city's 23½ acres of sanitary fill have been used. Breakdowns are few, far between, and seldom cause any important delay in his operations, despite the rough and heavy work necessitated by the sanitary fill process.

The Lewiston Swimming Pool

(Continued from page 33)

being the only other thing done by the contractor before winter, at a cost of $633.14. But city crews removed forms and cleaned up the premises at a cost of $302.19 to expedite pouring of the filter house floor in the spring.

When work was resumed late in February, 1947, all prices (with the exception of concrete) had risen at least 10%.

The filter house was the first to be completed. A 6" floor slab of 35¼ cu. yds. of concrete was laid at a total cost of $696.61, the floor drainage was completed for $25.25, and large double doors were hung for $109.99. The total cost of filter house and ramp was $8,052.29.

Then the big job started—construction of the swimming pool proper. Approximately 1,500 yards of earth was excavated at a total cost of $526.13, or 35.1¢ per cu. yd. Form construction for the pool proper was completed at a total cost of $4,212.75 making the all-over cost 78.7¢ per sq. ft. of forms placed and stripped, or $14.951 per cu. yd. of concrete. Into these forms were placed 281.75 yds. of concrete for $5,098.95, making the cost in place, including concrete, placing and finishing, $18,097. The total cost per yard of concrete does not include the cost of sealing the slab joints with oakum and petrolastic asphalt Type X-X which cost $285.11, or 35.87¢ per lineal foot. Nor does it include the hand excavation necessary to fine grade

the pool bottom before the slab was placed, which cost $60.75.

The furnishing and installation of two 6" main drains, four vacuum cleaner outlets, 11 inlets of 2" size, and 34 scum drains cost $2,563.39 of which $1,355.45 was for labor. Three 96" diameter pressure filters were installed at a contract cost of $7,445.50. Four overhead floodlights, each supported on a 25' metal standard were installed around the pool so that it would be possible to have night swimming. This cost $447.35.

Finishing the Job

A thorough study of the different types of underwater paints was made, and the paint manufactured by the Inertol Company was chosen as best suited to the needs. The pool was painted at a cost of $424.38, or approximately 5.7¢ per sq. ft. of area. This work was done by city crews.

The sidewalk, which seems a small part of the job, cost $4,013.34 to form, place 126 cu. yds. of concrete and finish, making a cost of $33.445 per cu. yd. This does not include $175.02 steel cost.

The bath house was constructed of 8" x 8" x 16" concrete blocks. There were 3,593 blocks used in this construction, and they cost $1,802, or 50.2¢ per block in place. Labor and materials for woodwork, forms and roof cost $6,718.14. Painting of the bath house cost $79.28 for materials and $565.00 for labor, a total of $644.28 for a 3-coat job.

The total cost of construction for the bath house was $9,165, exclusive of labor and materials for plumbing, which cost $3,200.21 for 5 toilets, 1 urinal, 6 showers, an oil hot water heater, a hot water storage tank, and an oil storage tank. Lighting the bath house required $919.20 worth of light installations.

All work was done by Kenaston and Huntley, local contractors, under the supervision of W. P. Hughes, City Engineer, with Don E. Baird as supervising engineer in direct charge.

OVERALL REINFORCING STEEL COSTS

The following gives the breakdown of the overall reinforcing steels costs on the complete job.

FINAL STEEL ESTIMATE

Filter House	
Steel 18,578 lbs. @ .05849	$1,086.63
Placement 6,858 lbs. @ .034 & 10,640 lbs. @ .029	541.78
Sidewalk	
Steel 1946 lbs. @ .05849	113.82
Placement 1800 lbs. @ .034	61.20
Pool	
Steel 21,023 lbs. @ .05849	1,229.64
Placement 21,023 lbs. @ .034	715.16
Bath House	
Steel 200 lbs. @ .05849	11.70
Placement 200 lbs. @ .034	6.80
TOTAL STEEL BREAKDOWN	
Steel 41,737 lbs. @ .05849	2,441.97
Placement 29,880 lbs. @ .034	1,015.92
10,640 lbs. @ .029	308.56
Total Steel Cost	$3,766.45

41,737 lbs. @ $0.0902 per lb. in place.

For protection against vandalism a 6'2" fence, 2" mesh, was erected at a cost of $954.85 for 344', including an 8'-0" gate.

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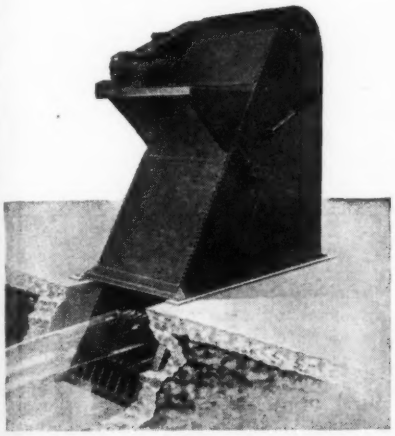
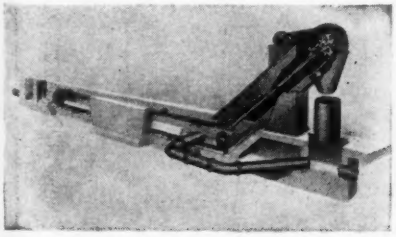
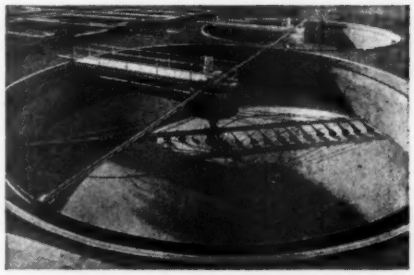
Small plants can obtain equipment that is equally efficient, equally economical and as durable as that for large plants. All Rex equipment and processes are time-tested and proved in hundreds of successful installations. Specially trained Rex sanitation engineers will be glad to help you with your problems. For facts write for your copy of Bulletin No. 46-3. Chain Belt Company, 1722 West Bruce Street, Milwaukee 4, Wisconsin.



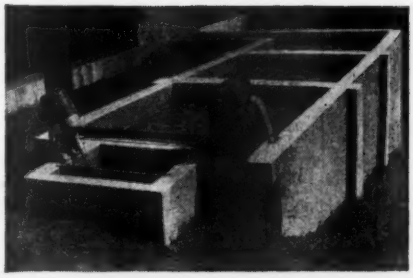
REX MECHANICALLY CLEANED BAR SCREENS are neat in appearance and provide an efficient means of removing large solids from liquids. They are easily installed in new or existing channels and have remarkably low head loss. With side frames recessed in channel walls, they assure an unobstructed flow to the rack.



REX TOW-BRO SLUDGE REMOVERS are the only sludge collectors which remove sludge from tank bottom immediately on contact instead of by the usual blowing or scraping. They assure accurate control of sludge removal over a wide range of withdrawal rates. Greater sludge concentration, greater operating flexibility and a clearer effluent are all readily obtainable with Tow-Bro. ▶



REX FLASH MIXERS AND FLOCTROLS provide the necessary rapid dispersement of chemical throughout the liquid, followed by a gently multi-stage slow mixing for optimum floc formation. Floctrol designs assure utilization of full tank volume and important savings in chemicals. ▶



REX CONVEYOR SLUDGE COLLECTORS combine the well-known advantages of the rectangular settling tank with a rugged and efficient form of sludge removal mechanism. Whether handling primary sludge or light flocculent solids, their performance is trouble free and dependable. They rarely need to operate more than a few hours daily. ▶

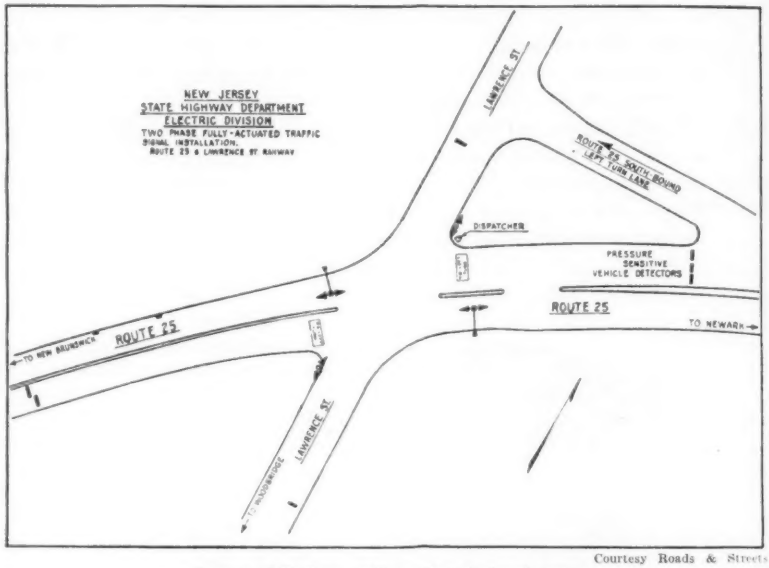
REX GRIT EQUIPMENT, incorporating the exclusive principle of recirculation, effectively separates and removes inorganic solids from liquids. No grit washer is needed. Long life is assured ◀ with minimum maintenance.

REX SANITATION EQUIPMENT
Member of the Water and Sewage Works Manufacturers Association
CHAIN BELT COMPANY of Milwaukee

The Highway and Airport Digest

Half-Mile of Concrete Paving a Day

In laying a 3-lane concrete pavement 33 ft. wide for 10.2 miles west from New Castle, Pa., the contractor used equipment which cost him $460 a day for overhead and equipment rental rates. He used 22 individual operating units spread for 2 miles along the highway, and 100 men working 58 hrs. a week. First a motor patrol grader resurfaced the previously compacted subgrade. This was followed by a 10-ton 3-wheel roller with scarifier; and this by 2 men setting stakes for the road forms; a form-grader excavating a narrow trench for the road forms; a form-setting gang placing the 9 x 9-in. steel forms, which were held by 18" anchor pins driven by a driving head in a pneumatic pavement breaker; (the contractor had 8,000 lin. ft. of forms); a subgrader operating on the forms; a 5-ton 3-wheel roller; a scratch template; a crew setting cross drains; a crew instaling expansion joints at 123 ft. intervals; a new wiring to one side form a metal strip to make the groove for the keyway between adjacent 11 ft. slabs; a 34-E dual drum paver; a concrete spreader; 2 finishing machines; a longitudinal screed; 3 longitudinal passes with a coarse burlap drag; men finishing transverse joints. The pavement was cured 72 hr. under non-absorbent paper; and all joints were sealed with liquid asphalt. A truck-mounted hydraulic crane was used to excavate the cross drains and to load the steel forms onto trucks. The price for the 190,000 sq. yd. of pavement was $3.58 per sq. yd. plus $0.15 for subgrade treatment.[E5]

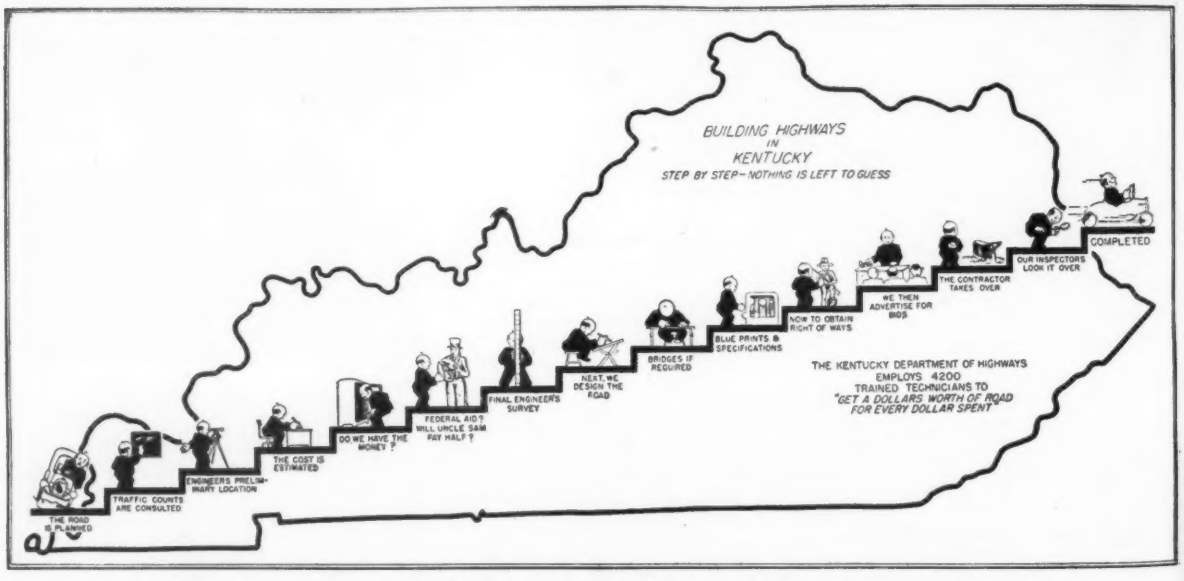


Courtesy Roads & Streets

Layout of 2-phase traffic activated signal system.

Signal System Operated by Traffic

The New Jersey Highway Dept. will soon place in operation at the junction of Route 25 and Lawrence St., Rahway, a "robot traffic cop." Traffic on Route 25 has reached 35,000 vehicles a day, and 6,000 on Lawrence St., exceeding the capacity of the existing semi-actuated traffic signal. The new system will keep a constant check of the traffic from each direction, pressure of passing vehicles on plates in the road surface sending records to a central dispatcher which operates traffic lights. With the green light on Route 25, each car approaching on Lawrence St. shortens the permissible "vehicle interval" on Route 25; and when the accumulated vehicles on Lawrence St. indicate a permissible interval between



Here are the procedures required to build a road. This graphical illustration is from the annual report of the Kentucky State Highway Department.

vehicles on Route 25 less than that actually existing, the red light is set against Route 25 and green light for the street.

When the light changes to green, it stays at this for a sufficient time to allow all the cars on the designated road, which had collected there while the signal was against them, to cross the intersection, the dispatcher "remembering" what this number was. There is a maximum period of time allowed between changes of the traffic lights, after which the change is made, whatever the traffic conditions.[N15]

Grading Baltimore's Airport

For moving 6 million cu. yd. of earth in grading Baltimore's Friendship airport, the contractor uses three types of equipment, one for over 2500-ft. haul (reaching a mile in some cases), a second for 2500 to 1000 ft., and the third for less than 1000 ft. For the long hauls he uses a pair of 2-yd. shovels and a Euclid loader feeding eleven 13-yd. Euclid bottom-dump wagons. The loader averages 500 cu. yd. an hour. For intermediate hauls he uses 13 Tournapulls with 12-yd. Carryalls, and 3 Terra Cobras with 14-yd. Wooldridge pans; loading these being assisted by 5 Caterpillar snatch tractors. Each of these units moves about 90 cu. yd. of dirt an hour. The short-haul fleet contains 11 crawler tractors pulling 12-yd. scrapers, assisted in loading by 3 bulldozers, and averaging 80 cu. yd. per hour. The haul roads are kept in good condition by bulldozers and patrol graders; and the sandy soil is kept damp by constant sprinkling.

The fill is spread in 8" layers and given a 4-pass compaction with 550 psi sheepsfoot rollers. The city has obtained a pneumatic tire roller for surface compacting which can be loaded to 400,000 lb. It rides on four 30 x 33-inch tires which cost about $5,000 each.[S2]

The 200-ton roller will serve to secure deep (5 ft.) compaction under subgrade in cuts and compact fills adjacent to pavements. Also it will detect weak spots under cuts, or poorly compacted spots in fills.[N16]

Raising Street Gutters

In Pueblo, Colo., a number of concrete curbs and gutters laid 20 to 30 years ago had settled, in some places as much as 6", partly because of ¼" expansion joints every 6 ft. As the concrete was broken, they could not be raised by mud-jacking. Guniting has been used successfully for raising the gutters, but did not bond well with the narrow curb top. However, the curbs had been laid with a 9" face, so that a 3" face or more was still exposed after raising the gutters. The most important part of the work was getting the surface of the concrete absolutely clean, which was done by sand blasting, using the gunite machine. Where this was done no spalling has occurred, even at the edges, which were feather-edged. The cost ran from 40 to 60 ct. a lineal foot, 20 ct. of which was for cleaning. It would have been materially less if the city had owned the guniting machine, for which, including the operator, it paid $6 an hour.[P8]

Removing Snow By Melting It

This winter there was used for the first time, on airports of Pittsburgh and Allegheny County, Pa., a 12-ton device which operates like a large flat-iron, heated by two oil-fired burners and mounted on an ordinary road grader. Traveling over the snow at 10 to 15 mph it melts a swath 12 ft. wide, the melted snow being wiped from the pavement by a squeegee mounted behind the heated pan. The cost is said to be one cent per cu. yd. of snow melted.[X3]

Parking Meters in Canada

Questionnaires answered by 208 Canadian communities relative to the use of parking meters indicated that their use resulted in noticeable reduction of congestion, saving of police

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time, economy in enforcement costs with improved enforcement, reduction in trucking and delivery times, reduction in the number of minor accidents to vehicles, elimination of doubtful violation cases, more convenient shopping, greater convenience to tourists, and increased municipal revenue.[O2]

Compacting Airport Trenches

In the construction of the Twin Falls, Idaho, airport, the main landing strip was crossed by trenches for ten large-diameter pipes and six ducts. To prevent possible settlement of the backfill in these trenches, compaction to 100% of modified AASHO density was required. To secure this, the contractor hand-placed the backfill material in thin layers which were meticulously tamped at optimum moisture, using hand-operated pneumatic tampers to a point 6" above the pipe. Then a single section of sheepsfoot roller drawn by a small tractor compacted the rest of the fill.[N12]

Designing Pavements For Heavy Wheel Loads

Since 1941 the Army Corps of Engineers has been conducting a series of static loading tests on full-scale concrete slabs with thicknesses varying from 6" to 24". Many more or less tentative conclusions have been reached concerning use of base course, joint transfer, slab size, reinforcement, stresses, overlaid pavements, etc. A few of these are stated briefly in this article. Concerning the value of granular base courses under airfield paving, the author says: "Without exception, when a base course has been used on a less rigid subgrade in supporting a rigid pavement, and that pavement has been overloaded so as to cause serious initial failure, subsequent traffic on that pavement causes much more rapid destruction than it would on the same pavement without a base course."

Concerning reinforcement, he says that in general reinforcement, although it produces distinct structural benefits, is less economical than increased thickness of slab. If aircraft loads increase in the future, the use of truss-like concrete slabs with structural steel top and bottom, well separated, offers attractive possibilities for a solution. Even now, this type of construction is being investigated.

As to joints and transfer devices, free joints should never be used; keyed construction joints are very objectionable, expansion joints should be avoided if possible; doweled construction and dummy groove joints are better.

In building up inadequate pavements, they found that addition of as little as 3" of asphaltic concrete gave "astounding structural benefits;" so much so that "original designs utilizing a rigid slab of moderate thickness covered with a flexible-type surface can and probably will be in cost competition where conditions are favorable."[L4]

Minimizing Paving Costs

In order to obtain as low bids as possible on 550,000 sq. yd. of concrete street paving, Detroit, Mich., combined the jobs into groups, each totaling 20,000 to 90,000 sq. yd. on 7 to 22 streets, all the jobs in each group being in the same neighborhood. This permitted contractors to eliminate long moves from job to job and use economies not practicable for small, scattered jobs. On short streets they used transit mixers, on long jobs standard paver mixers. The jobs let this year have averaged $5.50 per front foot.

Minor economies have been obtained by omitting expansion joints except at intersections and the middle of very long blocks; contraction joints being placed at 20-ft. intervals. The pavements have an 8-6-8 cross-section, with integral curb. Air-entrained portland cement was used, to resist the effect of weather and of salt used in snow removal.[J3]

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2-Way Radiotelephone for TVA

The Tennessee Valley Authority is installing 154 Motorola central station and mobile unit radiotelephones to keep repair crews in touch with headquarters and with each other. Of the 154 installations, 24 will be fixed stations at division and district headquarters and 130 will be mobile units installed in various types of maintenance vehicles.

Digging a Hole in 25 Seconds

A power posthole digger has been mounted on a Ford motor truck by the Cater Electric Co., Ogallala, Nebr., and is used for digging pole holes for rural electrification. It can dig a hole in 25 seconds. Power is by takeoff from the truck engine.

Traffic Jams Occur in the Arctic

Fairbanks, Alaska, has its parking problems and will soon install parking meters guaranteed to operate at temperatures to 35° below zero. Below that temperature, the city manager says that parking problems are not so great. No mention is made of snow problems, but it is thought that they may occur.

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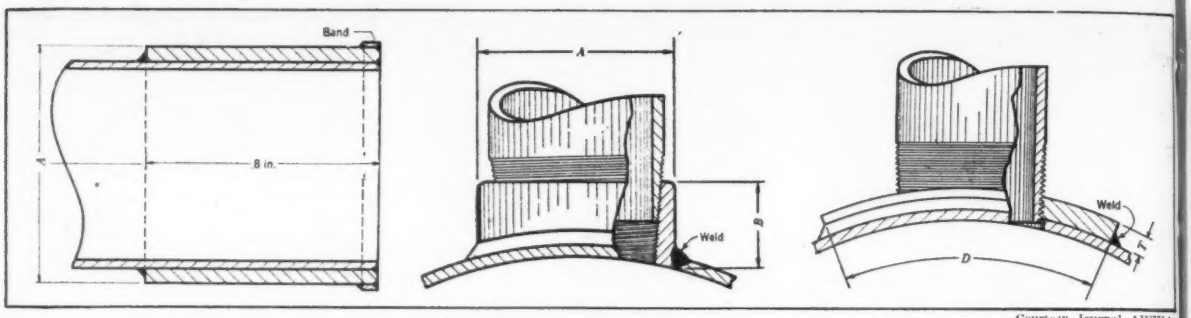

Courtesy Journal AWWA

Making joints and connections with steel pipe: left, spigot for joint with cast iron; center, welded coupling for threaded outlet; right, reinforcing pad for tapping.

The Water Works Digest

Use of Steel Water Pipe

Steel water pipe that meets the AWWA specifications is satisfactory for supply lines, equalizing mains, force mains, underwater river crossings, bridge crossings, swamp or marsh crossings, water purification plants, pump station piping, sewage disposal lines, pressure sewers, storm sewers, and water well casing. The author discusses at length the determining of the size of supply lines, determining the wall thickness, field joints, special connections, and protective coatings.

Concerning wall thickness, he says that enamel-lined pipe must be thick enough to prevent damage to the lining while shipping and installing. Concerning corrosive action of soils on steel, he classifies as lightly corrosive—coarse sands or sandy loams, light textured silt loams, and porous loams or clay loams thoroughly oxidized to great depths, all with very low water table. Average corrosive are well drained sandy loams and silt loams, well drained. Badly corrosive are clay loams and clays with heavy texture, with water table at about pipe depth. Unusually corrosive are muck, peat, tidal marsh and adobe clay, with water table at the surface or extremely impermeable because of colloidal material. For protective coatings he recommends, for pipe 30" and larger, coal-tar primer followed by coal-tar enamel for both interior and exterior surfaces, with coal-tar saturated felt bonded to the exterior by coal-tar enamel. For sizes below 30", the same as above, followed by a second layer of coal-tar saturated felt similarly applied and an additional application of coal-tar enamel over the felt, covered with whitewash or kraft paper. For exposed pipe (as on bridges), coal-tar primer and enamel for interior surfaces only, the exterior surface receiving red lead primer covered with white enamel and/or aluminum finishing coat.

For making connections to cast-iron pipe, the best method is to weld a spigot on the end of the steel pipe. For connecting to a steel pipe a threaded steel pipe (which should not be larger than 4") the best method is by use of a half coupling, as shown by the illustration. If it is necessary to tap threads in the side of comparatively thin-wall, large diameter pipe, weld on a reinforcing pad ¼" to ¾" thick, depending on the size of the tap.[A15]

Rapid Pipe Laying

Giddings, Tex., several years ago found it necessary to lay several miles of water mains as speedily as possible, using cast iron. Calking oakum and lead was time-consuming, and after trying rubber ring gaskets and lead on one street with satisfactory results, followed by rubber gaskets and "Mineralead" on a second street, the rest of the work was completed using these materials, saving practically all the time required for calking, and much of the cost of lead. Fire trucks pumping on small mains had caused leaks in the old mains, but did not in these. Joints made with Mineralead sometimes leaked for several days, but not if the pipe line was covered as fast as the joints were made. Four men easily lay 350 ft. of 8" main in a day by this method.[P4]

Miami's Sand Catcher

The water supply of Miami, Fla., is drawn from wells in limestone which contains lenses of fine quartz sand, about 20% of which passes a 100-mesh sieve. A sand trap has been constructed to prevent this sand from entering the flocculating devices and clarifiers. The sand trap is a concrete box 20 x 30 ft. by 25.5 ft. deep, in which is set the frustrum of an inverted pyramid, the open bottom of which is 5 ft. square and the walls of which at the top rest against the walls of the box, forming a hopper. Each wall of the hopper contains a vertical slot 9" wide. Water enters the box near the bottom at one corner, travels around the space between box and hopper to keep the sand in suspension, and enters the hopper through the four slots. As it rises through the hopper the velocity decreases as the area of the hopper increases. It was calculated that the sand would settle out if the velocity was not over 0.0767 fps, and the rate of flow into the sand trap is limited to that which will give this velocity at the top of the hopper. The water overflows into two troughs whose edges are 8.79 ft. above the top of the hopper. The sand settles out through the bottom of the hopper into a well 3 ft. deep, from which it is drawn off at intervals through a 6" pipe, being agitated by a 2" jet of water under pressure should it become packed in the well.[E7]

Clean Filters

Several water superintendents replied to the question "what is a *clean* filter," most of them agreeing that the word should be used in a relative sense—that no filter is actually clean when in use. If satisfactorily clean is meant. This varies from plant to plant. H. F. Blomquist said that to produce consistently a satisfactory effluent,

1. The filter must be free from cracks, mud balls, hard spots, mounds, craters, algal growths, organic matter and mineral deposits which tend either to enlarge the sand grains or cement them together.

2. It must wash with an even expansion of the filter bed, and the washing must be continued with adequate velocity of upflow to carry away the impurities until the wash water becomes fairly clear. An experienced operator's sense of observation can determine when this point is reached.

Experience in water purification has taught us that the treatment given water before it flows to the filter has much more to do with the success or failure of a purification process than the filter element has. Adequate coagulation of the reagent used for that purpose and sufficient sedimentation time and facilities to prevent high turbidities reaching the filters do more to maintain clean

filters than mere filter washing. Prechlorination before filtering, sufficient to leave 0.2 or 0.3 ppm of residual chlorine in the filter effluent, keeps filters sterile and prevents organic growths under our local treatment conditions.

Therefore, a clean filter bed could be designated as one that is free from mud deposit formations within the bed, mud ball deposits on its surface, and has been made so by the backwashing and surface washing procedures.[F11]

Watersheds of Bridgeport, Conn.

The Bridgeport Hydraulic Co. supplies to about 250,000 persons an average of 37 mgd, which is collected from a watershed area of 91.2 sq. mi., of which the company owns 31.2 sq. mi. There are 4 distributing reservoirs, 2 storage basins, and 4 diversion and collection reservoirs. At each reservoir is a caretaker and assistants who clear underbrush, mow flow lines and patrol for trespassers; and those at the four distributing reservoirs operate the chemical treatment plants there. An income is derived from a 210-acre apple orchard, saw mill and sale of Christmas trees. Large areas of pine trees protect the land from erosion and the reservoirs from blowing leaves. An aerial survey of the watersheds has been made and mapped to scale of 1"=1200 ft., which has been found very valuable. Among other things it located 2[illegible] houses which they had not known were within the limits of the survey and were violating the sanitary laws. They also use U. S. Tactical Maps, obtained from the Army Map Service, with a scale of 2½" to 1 mile.

State Sanitary Regulations requiring sanitary disposal units for all houses on the watershed are enforced. Septic tanks are considered the most lasting and efficient They are made of concrete with reinforced concrete tops, and discharge into leaching trenches with a 3 x 3 ft. cross-section or larger, with side of field stone. [B2]

Ranney Collectors

A Ranney collector consists of a well down to an aquifer, from the bottom of which 8" strainer pipes are driven radially in a horizontal plane into the aquifer for 100 to 250 ft. in all directions. Water entering them is filtered through the ground and in all cases to date all suspended matter such as bacteria, colloidal color, and taste and odor-producing organisms were completely removed. By placing the horizontal pipes above any iron-bearing soil, no iron in solution enters the pipes, as the movement of water toward them is very slow and it all enters from above. Most of these collectors have been used for industrial purposes, but several are in use by municipalities, the water being chlorinated. Where the pipes are run under the Ohio river, sediment on the river bottom is scoured out by each flood or freshet and new material deposited by the river.[B3]

Utilizing Sewage Effluents

Many cities can, by the salvage of sewage effluents for industrial purposes, extend materially their ability to offer adequate water supplies to prospective industries. The author lists 7 plants where effluents were being used for cooling purposes; 2 railroads using it for boiler water; and other miscellaneous uses; besides use for agriculture in 124 places. To make the use of effluents for industrial purposes worthy of consideration:

1. There must be a local industry in need of water for purposes that do not involve human consumption.
2. There must be a sewage treatment plant large enough to furnish the amount of effluent required.
3. The costs of processing and furnishing effluent must be less than those involved in the use of another source of supply.[A13]

Water for Industrial Uses

The author warns against the widespread use of sewage effluents until all engineering and economic phases of the undertaking have been surveyed.

The major needs of water by industries fall within one or more of the following groups:

Cooling Water—Surface condensers, Heat exchangers and Jet condensers.

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Miscellaneous Uses—Clean-up water. Lawn sprinkling, gardening, etc.

The largest single use of water by industries is for cooling purposes. For these, the temperature of the water is very important and that of the public supply frequently determines the selection of a plant site. Also affecting its utility for cooling purposes are scale-forming constituents, suspended matter, dissolved corrosive gases, acids, oil or other organic matter and slime-forming organisms.

Water which is applied directly to a product must be treated selectively to meet the specific requirements of the particular product manufactured. Such treatment is generally applied by the industry; the poorer the quality of the raw water, the more costly will be the treatment. For boiler feed, soluble silica is particularly detrimental, tending to form dense, hard scale on heating surfaces.[A14]

When you need special information—consult the **ENGINEERS' LIBRARY** *on pages 77-80*

Reconditioning Old Cast-Iron Pipe

During the past year, Los Angeles, Calif., has reconditioned 16,000 ft. of cast iron pipe removed from its streets. The trench excavation is by machine down to the pipe, completed by hand; the pipe is lifted by a crane, the lead joints melted by oxy-acetylene torch, and the pipes taken to the yard. There they are scraped and grit-blasted to a foundry-fresh condition and lined with a 50:50 mixture of cement and sand. This is applied by the extrusion process uniformly over the inner surface as the pipe is revolved very slowly; and the speed is then increased to a peripheral velocity of 1500 fpm. For curing, the ends of the pipe are capped to retain the moisture, the lining being wet twice daily for two days. The outside is given a thin coat of a coal-tar base paint.[E4]

The Second Mokelumne Aqueduct

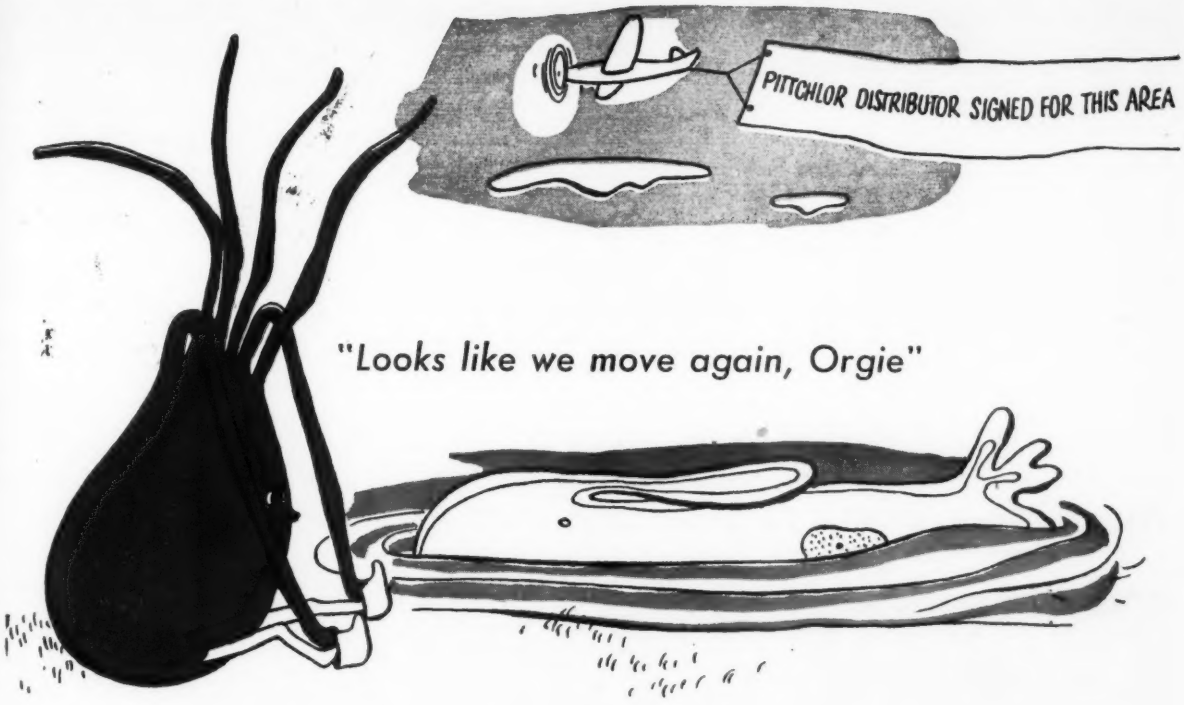
The original Mokelumne aqueduct which was laid in 1929, is being paralleled by another to meet increased consumption demands. The latter contains 30 miles of 67″ and 68″ pipe. Steel is being used as in the original aqueduct, but is lined with cement instead of asphalt enamel, and coated with cement rather than felt wrapping; also the field joints are being welded, while riveting was used for the first line. Bids for concrete pipe also were received, but the lowest for this was $6,879,950 as compared to $6,461,155 for steel. For the field welding, 34 electric welding machines are being used. The lining is placed centrifugally, for which some new details are necessary because of the unusual size of the pipe. The mortar coating is sprayed with great force against the outside of the pipe which is first wrapped with a ¼″ rod under 500 lb. tension; the mortar having only 0.37 parts of water to 1 part of cement. [E5]

Cathodic Protection of A 2,000,000 Gallon Tank

Shreveport, La., has constructed a 2,000,000-gal. tank with a bottom of radial-cone design, 102 ft. in diameter, with a riser pipe 10 ft. in diameter. For cathodic protection there are 12 aluminum anodes, one hung down the riser pipe to within 5 ft. of its bottom; the other 11 distributed around a circle 11 ft. inside the tank walls and 27 ft. long, suspended from the roof and terminating 11 ft. from the tank bottom. The central anode is a ½″ rod, the others are 1″ rods. A.C. current is supplied by a domestic electric line and converted to direct current. The cathodic protection cost $1,400; the tank cost $212,000.[G8]

A Convertible Softening Plant

Sarasota, Fla., uses for its public supply very hard water from wells, which it aerates and softens by use of zeolite. It expects to change to a soft



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surface supply in the near future, but needed an immediate increase in softening capacity to meet present increasing demands. This increase has been obtained by installing a 1 mgd zeolite softening plant; but so that this addition can be used when the change is made to a soft surface supply, the zeolite filters are placed in the same type of structure used for standard automatic gravity filters, including surface wash and filter controls. The change then will require little but the substitution of sand for zeolite. As zeolite beds, they will be used at the rate of 1.1 gpm per sq. ft.; as sand filters the rate will be 2 gpm.[J2]

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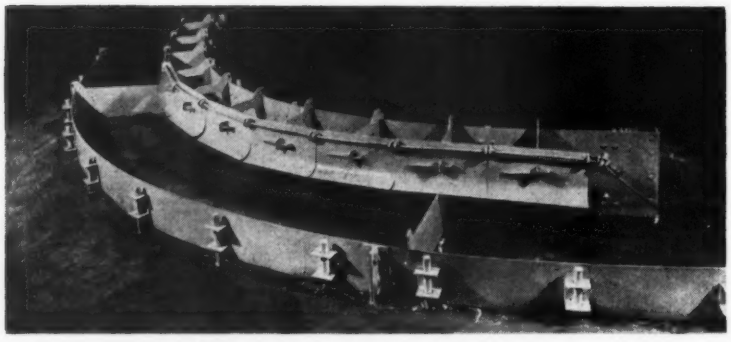
PUBLIC WORKS Magazine, 310 East 45th St., New York 17, N. Y.

PUBLIC WORKS Equipment News



Blaw-Knox articulated curb and gutter forms.

Articulated Forms for Curb and Gutter Construction

This is a new type of articulated flexible steel face forms for curb and gutter work. Forming of a battered curb face is simplified and any reasonable radius of curvature is possible. The sections, all 1 ft. long, and all identical, are assembled on a steel cable, which is passed through eyelets welded at both ends of the 1 ft. sections. The use of these forms on a curve results in a series of short chords, the marks of which can be eliminated in finishing. Fuller information from *Blaw-Knox Co., Pittsburgh, Pa.*

A Big Diesel Crawler Tractor

The new International TD-24 diesel crawler tractor has 180 hp. at the flywheel and 140 drawbar hp. It weighs 19 tons; and it is claimed to be the most powerful tractor on the market. It has 4460 sq. ins. of ground contact with the regular 22-in. shoes, and 1513 sq. ins. of bracing grouser area. For full information, write *International Harvester Co., Chicago, Ill.*

Anti-Corrosive Coatings

Two new types of anti-corrosive "Zinciliate" coatings have been announced. These can be applied by dipping, spraying, brushing or roller coating. The coatings are sufficiently flexible so that sheets, pipe and forms can be bent double without breaking the protective coating. *Industrial Metal Protectives, Inc., Dayton 2, Ohio.*

"Kilroy Was Here"

Kilroy, in this case, is a portable service station capable of servicing completely the mechanized units operating on a construction job. It carries 700 gals. of gas, 200 gals. of oil and grease, 60 gals. of water or anti-freeze, kerosene, compressed air for tires, and tools. It is towed by a truck or tractor to the site of the work. This portable service unit should be highly useful for construction work of even moderate size, and should soon pay for itself. Write to *Jax, Inc., 4925 Friendship Ave., Pittsburgh, Pa., for full dope.*

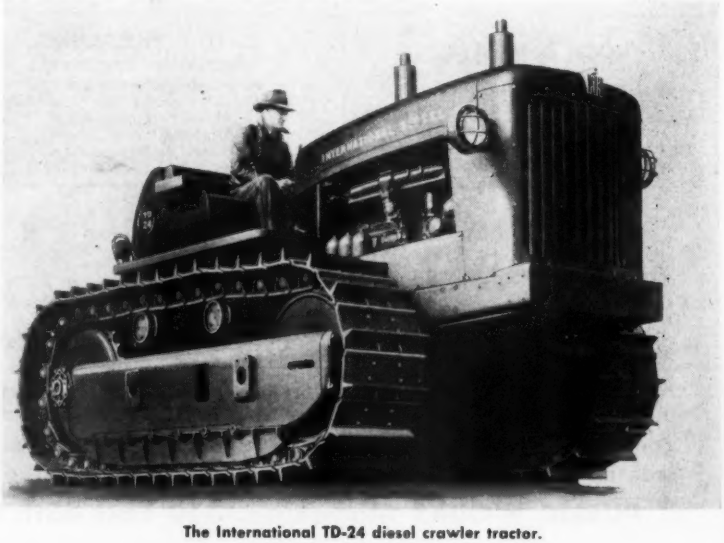
A Useful Traffic Line Marker

This gas engine model machine is designed for city, county and town use. It operates over rough or smooth surfaces; no sweeping of the surface is necessary; the line width is adjustable from 3 ins. to 8 ins. The feed tank is 2½-gal. The unit may also be used as a general paint sprayer, particularly for spraying over stencils for traffic and similar signs. *Industrial Tool and Products Corp., 614 Jefferson Ave., Rochester 11, N. Y.*

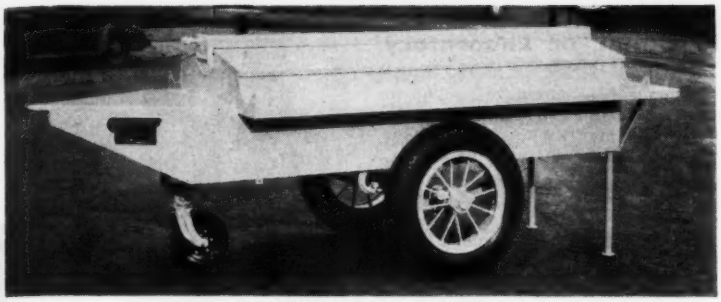
Industrial street traffic liner.

Pipe Insulation for Indoors or Outdoors

The new "foamglass" insulation can be used for both hot and cold lines, indoors and outdoors. It is of true glass composition; is non-combustible and acts as a fire retardant; it is waterproof and vaporproof. It comes in 18-inch half-sections, for all sizes of pipe. It may be used from minus 200°F to plus 800°F. For full data write *Pittsburgh Corning Corp., Pittsburgh, Pa.*



The International TD-24 diesel crawler tractor.



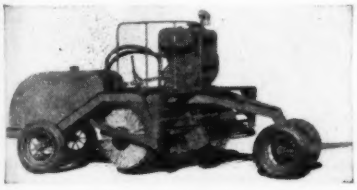
The Littleford all-metal tool box.

Littleford All-Steel Tool Box

This portable tool box is of all-steel welded construction, light in weight, absolutely fireproof, weatherproof and thiefproof. A safety catch holds the covers locked in open position. Locking chains permit the box to be left on the job. Sliding shelves and compartments are provided for all kinds of tools and supplies. The illustrations shows how nice a job this is. Write *Littleford Bros., Inc., 452 E. Pearl St., Cincinnati, Ohio.*

An All-Purpose Street Cleaner

This is a unit specifically designed for street cleaning, but adaptable also to a wide variety of other uses: It will, say the manufacturers, pressure

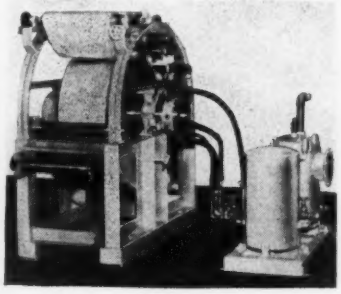


Rosco street cleaner.

flush and sprinkle streets, clean sewers, sweep wet or dry, spray trees and shrubs and fight fires. It tows easily, and is powered with a 15hp. engine. Ask for Data Sheet 548B, *Rosco Mfg. Co., Minneapolis, Minn.*

Sludge Filter Pilot Plant for Rent

A pilot plant model of a continuous rotary vacuum filter, with a filtering surface of 10 sq. ft. is available for purchase or rental. This arrangement permits installation of such a filter for testing or trial installation, or for small or temporary jobs; and the filter can be purchased later if desired, or paid for on a rental basis. A bulletin, No. 102, shows how this rotary vacuum filter operates, and the illustration herewith shows the pilot plant. For full information on your problem, write to *Filtration Engineers, 858 Summer Ave., Newark 4, N. J.*



Pilot plant sludge filter.

Flow Measurement for the Laboratory

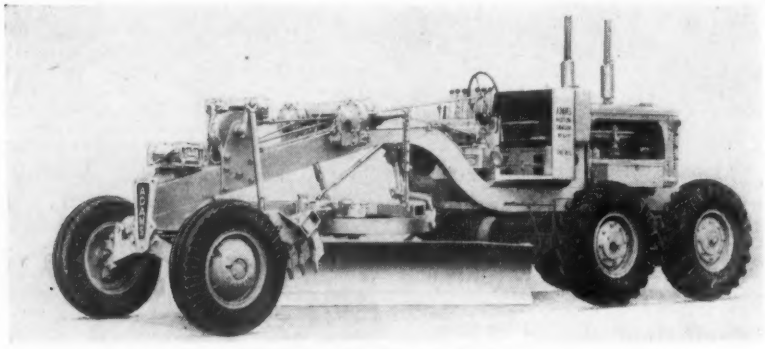
This rotameter set is designed to meet the requirements of the research laboratory. It consists of a metering tube holder with base plates and hose connectors, 4 readily interchangeable tubes, and 6 metering floats, complete

with calibration data. Capacities are from 0.065 to 2,200 ml./min. of water and from 5.0 to 36,800 ml./min. of air. For full information, write *Dept. 2 E-J, Fischer & Porter Co., Hatboro, Pa.*

A Heavy and Powerful Grader

Powered by a 100 h.p. UD-16 International Diesel engine, this new grader weighs over 25,000 lbs. without accessories. With over 18,000 lbs. on the rear wheels, ample traction is provided to make full use of the 100 h.p. engine. Exceptionally easy operation is insured by a mechanical-hydraulic steering mechanism furnished as standard equipment. The blade is 12-ft., 31 ins., wide. Speed is 2.6 to 25 mph.

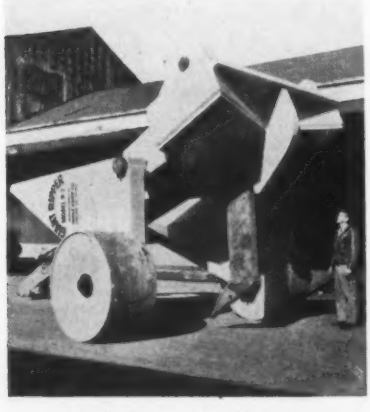
Full information from *J. D. Adams Mfg. Co., Indianapolis, Ind.*



Adams No. 610 diesel motor grader.

Ripping 6 Ft. of Hard Ground

A 17-ton special giant ripper for breaking hard ground to a depth of 6 ft., and requiring 3 or 4 of the biggest tractors to pull it, is a late addition to heavy construction equipment. It is especially adapted to ground breaking ahead of ditchers on pipe line or cable laying jobs; and it reduces the needs and delays of blasting. Complete specifications from *Soule Equipment Co., Freight and Ferry Sts., Oakland 7, Calif.*



Soule 17-ton Giant Ripper.

A Constametric Pump for Pilot Plant or Laboratory

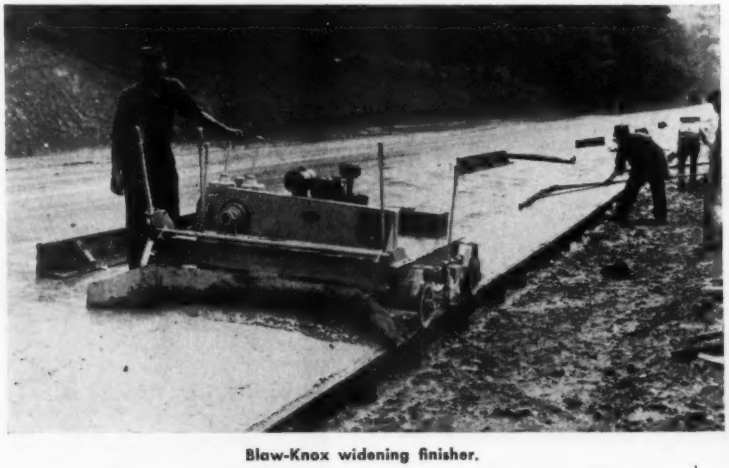
This means, according to the manufacturer, that this pump will pump at a constant controlled flow, without pulsations, even at capacities as small as 75 ml. per hour. It is made in 5 sizes, from 75 ml. per hour to 34.2 gals. per hour. It can be furnished in metals for almost any acids or alkalies. Capacity is adjustable while pump is in operation. Especially designed for laboratory and pilot plant work. *Milton Roy Co., 1300 E. Mermaid Ave., Philadelphia 18, Pa.*

Top Suction Sump Pump

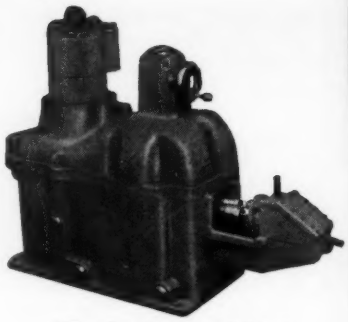
This pump is designed to overcome one of the causes of pump failure, that is, the breaking of the pump shaft seal because of water pressure. Designated the VP-4, the pump is light in weight, easily moved, is operated by a vane-type air motor, and has a closed type impeller of exceptionally hard, abrasion resistant alloy. A built-in oiler lubricates all moving parts. *Gardner-Denver Co., Quincy, Ill.*

Blaw-Knox Widening Finisher

The illustration herewith shows the new Blaw-Knox widening finisher in use on Route 66, Pa., between Ford City and Leechburg. It is adjustable to widths of 2 to 6 feet; has one forward traction speed suitable for all normal work and one high reverse; it has two screed speeds. Data from *Blaw-Knox Co., Pittsburgh, Pa.*



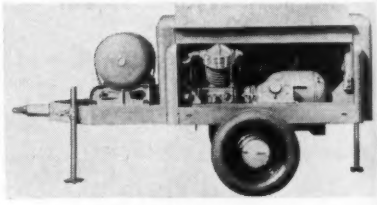
Blaw-Knox widening finisher.



Milton Roy Constametric Pump.

Portable Electric Air Compressors

These new electric portable compressors have capacities of 60, 105, 160, 210, and 315 cfm. They are available in skid, 2-wheel and 4-wheel trailer mountings, and are 2-stage, direct driven from 220-440 volt AC motors. *Davey Compressor Co., Kent, Ohio.*



Davey portable air compressor.

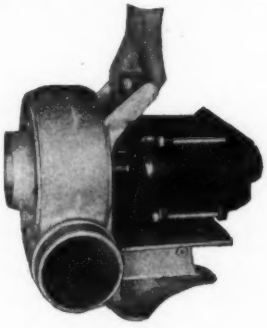
2-Yd., 4-Wheel, Powered Hauling Unit

To provide low-cost movement of bulk materials, this unit has a 2-yd. hydraulically dumped body, and is powered with a gasoline engine. It is

equipped with pneumatic tires on all 4 wheels. It is low to facilitate loading. There are 2 forward and 2 reverse speeds. Full visibility in every direction. For full description, write *Frank G. Hough Co., 802-E Sunnyside Ave., Libertyville, Ill.*

PORTABLE VENTILATOR

This is an electric driven ventilator, which weighs only 50 pounds, but has a capacity of 425 cfm. of air. It can be used as a blower or an exhauster. Just



Portable ventilator.

what many municipalities need for sewage treatment plants, sewer manholes, tanks, vats and other places, to safeguard personnel. Also usable effectively for spray painting and other purposes. Write *United Electric Motor Co., 178 Centre St., New York.*

TECHNICAL REPORTS

Treatment of Cyanide Wastes by Chlorination.—This is a 14-page reprint of an article on this subject by John G. Dobson, Technical Service Division, Wallace & Tiernan Co., Newark, N. J. The article originally appeared in Sewage Works Journal, Nov., 1947. Additional copies are available from Wallace & Tiernan.

Sound Insulation of Wall and Floor Constructions.—This is a report by the Bureau of Standards issued in 1939; a supplement was issued in 1940; and the second supplement now has been published. The original report, BMS 17, and supplements 1 and 2 can be obtained from the Superintendent of Documents, Washington 25, D. C., for 35 cents.

Highway Statistics, 1946. — The Public Roads Administration has issued the second bulletin of a series presenting statistical and analytical tables on motor fuel consumption, motor vehicle registration, state highway-user taxes, financing of state highways and highway mileage. This is 50¢ from the Superintendent of Documents, Washington, D. C.

Uses of Traffic Accident Records.—A manual on how to use traffic accident reports for prevention of further highway accidents has been issued by the Eno Foundation for Highway Traffic Control, Inc. For copies of this manual write Yale University News Bureau, 2061 Yale Station, New Haven, Conn.

PERSONNEL CHANGES

Jeffrey Mfg Co., Columbus, O., has announced personnel changes as follows: Howard S. Davies from Baltimore to Chicago, as District Mgr., Conveyor Division; H. C. Rockwell from Columbus to Baltimore; and Paul Hendry succeeding at Columbus. W. K. Myers goes to the Boston Office, and H. A. Lee to St. Louis, succeeding F. L. Kolb, who goes to Chicago. Sales engineer transfers include E. J. Woltz to Harlan, Ky., J. R. Brisley to Philadelphia, N. S. Bell to New York, W. T. Davis to Houston, and J. W. St. John to Pittsburgh.

Jaeger Machine Co., Columbus, has moved its eastern regional office from New York to 1504 Widener Bldg., Philadelphia. L. T. Phillips is manager.

W. A. Roberts and W. C. Johnson, executive vice-presidents of Allis-Chalmers have been elected to the board of directors of that company.

Clark-Wilcox Co., Boston, Mass., have been appointed distributors for Carter Pumps in Maine, N. H., and Mass.

B. F. Devine, L. B. McKnight and O. W. Carpenter have been elected vice-presidents of Chain Belt Co., Milwaukee, Wisc.

WHAT OUR READERS SAY:

Comment and discussion on current engineering matters are invited.

Water-Borne Diseases:

GENTLEMEN:

We noted with great interest the compilation printed in your article under the title of "Water-Borne Disease Outbreaks" in the November issue of PUBLIC WORKS Magazine. We are sure that this information in this form will be of considerable value to people in the water works and public health fields. We wonder if you would not like to call the attention of your readers to the fact that these reported water-borne disease outbreaks consist only of those reported to the Public Health Service by state health authorities and certain large municipalities, and are not to be considered as a complete reporting of all outbreaks for the country as a whole.

M. D. HOLLIS, Ass't Surgeon General,
Chief, Sanitary Engineering Division,
U. S. Public Health Service.

Thank You:

GENTLEMEN:

I wish to express my gratitude for the helpful and interesting material found in your publication of PUBLIC WORKS Magazine, which is mailed to my office. I wish also, at this time, to inform you of a change of mailing address from N. G. Damoose to R. R. McIntosh, Director of Public Works, Room 2, City Hall, Battle Creek, Mich.

R. R. MCINTOSH, *Director.*

What's in a Degree?

GENTLEMEN:

I took time to read the January issue of PUBLIC WORKS as soon as it arrived, and I am glad that I did because I discovered one of your notes concerning the adoption of a five year engineering course by Rice Institute.

As you know, Rice is following what appears to be an increasing trend in recognition that engineers cannot be trained professionally in four years of undergraduate work. They also recognize the fact that an engineer must be exposed to some cultural information which at one time was considered completely unnecessary for the technically trained engineer. Rice is accredited by Engineers' Council for Professional Development for its civil engineering curriculum. Insofar as I know, they are not giving any option in sanitary engineering. I am not particularly pleased by their plan to give an A.B. degree in four years and a B.S. degree for the fifth year. In my own mind, and this is supported by field observations, the A.B. degree or the B.S. degree are somewhat equivalent and both are undergraduate degrees. I definitely feel that the engineer should receive a professional degree for his fifth year of work.

It all comes back to the question, "What's in a degree?" A five-year graduate from Rice has no better chance, according to some standards recognizing degrees as basic qualifications, than a four-year graduate from some other institution who also has a B.S. degree. It is high time that more than talk takes place in the reexamination of the academic education which is necessary for engineers.

WILLIAM T. INGRAM

[Ed. Note: This is part of a long letter from Mr. Ingram. Needless to say, we agree fully with his statement that a professional degree should be given for the fifth year of study.]

We Thought So Too:

GENTLEMEN:

Just wanted to thank Messrs. Frith and Cady for "The Gravity Flocculator for Water Treatment." I think it was a splendid article and could be used as a supplement to many existing text books on water treatment.

HARRY O'B. BELLINGER,
Ass't. City Engineer, Columbia, S. C.

Not a Noun:

GENTLEMEN:

In your December issue, beginning page 19, there is an article making use of the name "Flocculator" as if it were a common noun. Instead of being a common noun, the name is a registered trade-mark that has been accepted by industry as indicating origin of certain types of liquid-agitating equipment sold by my client, The Dorr Co. The trade-mark was registered in the United States Patent Office on July 5, 1932, as Trade-Mark No. 295,572.

ARTHUR MIDDLETON,
New York, N. Y.

Glad to Have You:

GENTLEMEN:

We were very much impressed with the editorial article on page 7 of your December issue entitled "Durable Structures Need Good Engineering," and we would appreciate your permission to use the ideas expressed therein, in whole or in part, in some of our engineering promotional literature.

WESTCOTT & MAPES, Inc.,
Joseph T. Kennedy, Vice-President,
New Haven, Conn.

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Pittchlor for Water Treatment

503. Get your illustrated booklet P.W. now on *Pittchlor*, a high test calcium hypochlorite, containing minimum 70% of available chlorine. Address, Pittsburgh Plate Glass Co., Columbia Chemical Div., 5th Ave. at Bellefield, Pittsburgh 13, Pa.

For Completely Successful Trickling Filter Systems

562. There's a vitrified clay filter bottom block to fit every shape tank. These blocks can be laid quickly and easily by unskilled labor. For more information, full details, specifications and list of typical plants write any firm listed below:
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Bowerston Shale Co.....Bowerston, Ohio

Complete Data on Digester Accessories and Sewage Gas Controls

563. Sewage gas controls, flame traps, waste gas burners, regulators, condensate and sediment traps and other equipment for utilizing and safe control of sewage gas are described and illustrated in catalog PWS-3. For copy of this catalog write to The Vapor Recovery Systems Co., 2820 No. Alameda Street, Compton, Calif.

You Need This Useful Pump Data

564. For complete data on sewage and trash pumps, both vertical and horizontal centrifugals for pumping sewage and sludge ask for bulletin PW 6202. For data on plunger type sludge pumps ask for bulletin 6300. For either or both write: Yeomans Bros. Co., 1409 N. Dayton St., Chicago 22, Ill.

How to Save Wood From Decay and Termites

565. If you have decay or termite problems or want to prevent them get the facts today by writing for ths 32-page biooklet telling all about Pentachlorophenol. Write to the Dow Chemical Company, Midland, Mich., asking for booklet No. PE 49.

Portable Mixer for Any Cold Mix

567. For bulletin describing this portable mixer that will handle up to 3 cubic feet of any cold mix on an entirely new principle write to The Foote Company, Inc., 1954 State St., Nunda, N. Y.

New Versatile Power Grader

569. The Austin-Western 99-H power grader features all-wheel drive, all-wheel steer, high-lift blade, extreme reach and completely reversible blade. For folder describing, illustrating and giving specifications write to the Austin-Western Company, Aurora, Ill.

Concrete Forms For Every Need

608. There's a form for your need whether it's concrete pipe for sewer, drain or irrigation; forms for roads, bridges, tunnels or manholes; or a special form problem. For folders telling just what these concrete forms can do for you write Dept. PW, Concrete Forms Corp., 43 Cedar Street, New York 5, N. Y.

Diesel and Dual Fuel Engines

609. Facts, figures, illustrations and specifications on these engines are covered in an attractive series of booklets; yours for the asking. Address Worthington Pump & Machinery Corp., Harrison, N. J.

Saving Money by Cleaning Water Mains

610. This is the theme of an 8-page booklet that every water works executive ought to have. Gives results, figures, and new light on an old problem. Titled "Let's Look into This Matter." Address: National Water Main Cleaning Co., 50 Church Street, New York 7.

Want to Keep Swimming Pools Safe and Sanitary?

611. Such is the title of important 42-page illustrated booklet suggesting solutions to many common problems of swimming pool sanitation and operation. Just address: Mathieson Alkali Works (Inc.) Dept. PW, 60 East 42nd St., New York 17.

Road Protection at Less Cost

612. There's no limit to the jobs you can handle with an Allis-Chalmers Package outfit consisting of the HD-5 Tractor with Tracto-Shovel and Model A-D Motor Grader. For booklets describing and illustrating these and other Allis-Chalmers Equipment write Dept. PW, Allis-Chalmers Tractor Division, Milwaukee 1, Wisc.

CONSTRUCTION AND MAINTENANCE

Speed Maintenance With This Portable Air Compressor

1. LeRoi Portable compressors in sizes from 60 to 500 c.f.m., gasoline or Diesel powered on mountings to fit your special needs. Same manufacturer makes both compressor and engine. Complete bulletin. Write LeRoi Company, 1770 So. 68th St., Milwaukee 14, Wis.

Solve Your Drainage Problems This Easy, Permanent Way

70. Useful new 60 page catalog on standard corrugated pipe, multi-plate pipe and arches and 18 other drainage and related products for culverts, sewers, subdrains, flood control, airports, water supply and other types of construction. Ask for "Armco Products for Engineering Construction," Armco Drainage and Metal Products, Inc., Dept. PW, Middletown, Ohio.

Reliable Every Purpose Pumps

117. New brochure by Gorman-Rupp Co., Mansfield, Ohio, illustrates and describes many of the pumps in their complete line. Covers heavy duty and standard duty self-priming centrifugals, jetting pumps, well point pumps, triplex road pumps and the lightweight pumps.

Data and Pictures of Complete Line of New Ford Trucks

532. Full line of new Ford Trucks for 95% of all hauling needs is pictured in colorful circular — Light Duty, One-Ton, Heavy-Duty and C. O. E. trucks. Also 48 out of over 100 standard, factory built chassis and body combinations. See before you buy. Write for your copy now. Truck and Fleet Sales Dept., Ford Motor Co., Dearborn, Mich.

Two-Way FM Radio Telephone Equipment for All Departments

541. For booklet describing and illustrating the Motorola Two-Way Radio Telephone or for specific recommendations concerning your aplication write to Dept. PW, Motorola, Inc., 4545 Augusta Blvd., Chicago 51, Ill.

Power Mower for Water Works, Sewage Plants, Highways, Etc.

553. For cutting the grass around your Water and Sewage plants and removing weeds and tall brush along your highways the Jari power scythe is just the thing you need! For a booklet describing this mower which is said to be easy to handle, economical to operate, fast and clean around trees and can be handled by one man write Dept. PW, Jari Products, Inc., 2936-F Pillsbury Ave., Minneapolis 8, Minn.

Diesel Engines to Help You Build Profits

560. A new 28 page catalog just off the press titled "Superior Stationary Diesel Engines," is packed with facts that will help you build profits. For your copy write to Superior Engine Division, National Supply Company, Springfield, Ohio.

SNOW FIGHTING

For High-Speed Snow Removal

350. "Frink One-Way Sno-Plows" is a four page catalog illustrating and describing 5 models of One-Way Blade Type Sno-Plows for motor trucks from 1½ up to 8 tons capacity. Interchangeable with V Sno-Plow. Frink Sno-Plows, Inc., Clayton, 1000 Islands, N. Y.

STREETS AND HIGHWAYS

How to Use Less Labor in Resurfacing

15. You can mechanize your resurfacing with these Portable Bituminous Mixers. 6 to 14 ft. sizes for resurfacing and maintenance. Helpful booklet issued by The Jaeger Machine Co., 400 Dublin Avenue, Columbus 16, Ohio.

Speed Your Work With These Powerful Motor Graders

128. Two powerful Galion motor graders designed to answer every requirement for more speed in road, airport, dam and housing construction work are fully described in a folder illustrated with many action pictures. Issued by Galion Iron Works & Mfg. Co., Galion, Ohio.

Here's a Roller for Every Need

141. Three-Wheel and Tandem Rollers, 5 to 8-ton and 10 & 12 ton sizes: also variable weight tandem roller for new highway surfacing and old road conditioning. Ask for new bulletin. Dept. P.W., Huber Mfg. Co., Marion, Ohio.

Here's Your Diesel Tractor!

190. Big 48 page catalog describes and lists many uses for International Diesel Tractors. Write International Harvester Co., Dept. P.W., 180 North Michigan Ave., Chicago 1, Ill.

Latest Maintenance Equipment For Blacktop Roads

290. "Blacktop Road Maintenance and Construction Equipment" — Asphalt and tar kettles, flue type kettles, spray attachments, tool heaters, surface heaters, road brooms and rollers. This is modern and up-to-date equipment for blacktop airport and road construction and maintenance. Write for Catalog R. Littleford Bros., Inc., 452 East Pearl St., Cincinnati 2, Ohio.

Need Street, Sewer or Water Castings?

429. Street, sewer and water castings in various styles, sizes and weights. Manhole covers and steps, inlets and gratings, adjustable curb inlets, water meter covers, cistern and coal hole covers, gutter crossing plates, valve and lamphole covers, etc. Described in catalog PW issued by South Bend Foundry Co., South Bend 23, Ind.

Practical Portable Power Units for Every Need

533. M-M power units with heavy duty engine, positive lubrication, easy servicing, handy controls may be just what you have been looking for. Simple, durable, practical. Get latest bulletin from Dept. PW., Minneapolis Moline Power Implement Co., Minneapolis 1, Minn.

SEWAGE DISPOSAL

Non-Corrosive, Long Lasting Low Cost of Sewer Pipe

72. Get this new engineering data on clay pipe for sewers. Withstands acid, alkali and gas attacks indefinitely. Cuts maintenance costs to a minimum. Write Dept. P.W., National Clay Pipe Mfrs., 111 W. Washington St., Chicago 2, Ill.

Does Air Sabotage Your Pipe Lines and Pumps?

357. Automatic Air Release Valves for water, sewage and industrial uses automatically vent air accumulations. Ask for latest illustrated engineering bulletins. Simpex Valve & Meter Co., 6750 Upland St., Philadelphia 42, Pa.

Valuable Booklet on Porous Diffuser Plates and Tubes

367. A valuable booklet on porous diffuser plates and tubes for sewage treatment plants. Covers permeability, porosity, pore size and pressure loss data, with curves. Also information on installations, with sketches and pictures, specifications, methods of cleaning and studies in permeability, 20 pp. illustrated. Write to Norton Company, Dept. P.W., Worcester 6, Mass.

Do Your Water Mains Need Cleaning?

388. Literature on Flexible method of cleaning water mains any size from 2" to 72", giving full details and list of nearest representatives in all parts of country. Address: Flexible Underground Pipe Cleaning Co., 9059 Venice Blvd., Los Angeles, Calif.

How to Select Main Line Meters

432. New bulletin illustrates Builders Air Relay system for liquids containing suspended solids like sewage. Eliminates corrosion, clogged pipes, etc. "The Selection of Main Line Meters," a highly informative and useful presentation, describes forms of differential producers and quickly solves typical problems with the use of graphic charts. Write Builders-Providence, Inc., Dept. P.W., 9 Codding St., Providence 1, R. I.

How to Make Concrete Pipe on the Job

440. Making concrete pipe on the job with local labor is the subject of a booklet sent on request by Quinn Wire & Iron Works, 1621 12th St., Boone, Ia., manufacturers of "Heavy Duty" Pipe Forms.

Concrete Pipe With Greater Elasticity

442. Lock Joint Reinforced Concrete Sewer Pipe, Pressure Pipe, Culvert Pipe, Centrifugal Pipe and Subaqueous Pipe is described and illustrated in bulletins available from Lock Joint Pipe Co., Ampere, N. J.

TO OBTAIN THESE BOOKLETS USE COUPON ON PAGE 77

Save Trucks and Labor In City Rubbish Collection

459. For saving trucks, labor, and time in city rubbish collection get details of the new Dumpster-Kolector described in literature just published by Dempster Brothers, Inc., 996 Higgins, Knoxville 17, Tenn.

Ask for This Design Data On Sprinkling Filters

469. Design data on sprinkling filters of Separate Nozzle Field and Common Nozzle Field design as well as complete data on single and twin dosing tanks, and the various siphons used in them, for apportioning sewage to nozzles. Many time-saving charts and tables. Write Pacific Flush Tank Co., Dept. P.W., 4241 Ravenswood Ave., Chicago 13, Ill.

Design Details for Sludge Collectors

480. Booklet No. P.W. 1642 on Link-Belt Circuline Collectors contains sanitary engineering data and design details. Catalog No. 1742 on Straightline Collectors, contains layout drawings, installation pictures and capacity tables. Address Link-Belt Co., 2045 West Hunting Park Ave., Philadelphia 40, Pa.

How the Hydro-Treator Works

486. 28-page catalog describes and illustrates the Dorrco Hydro-Treator, a self-contained water treatment unit combining Flocculation, Sludge Thickening and Clarification. Reduces treatment time and lowers plant construction costs. The Dorr Co., Dept. P.W., 570 Lexington Ave., New York 22, N. Y.

Packaged Sewage Treatment— Just Right for Small Places

488. "Packaged" Sewage Treatment Plants specifically developed for small communities — 100 to 3,000 population. Write for full description and actual operating data for this type of plant. Chicago Pump Co., 2348 Wolfram St., Chicago 18, Ill.

How to Stabilize Lime Softened Water

498. Engineering Bulletin describes stabilizing lime-softened water by recarbonation, discusses gas production, washing, compressing, drying, and applying the CO (2). Infilco, Inc., 325 West 25th Place, Chicago 16, Ill.

Engineering Details of Armcre Filter Blocks

525. Engineering bulletin shows construction details of Armcre Filter Bottom Blocks for better trickling filter results. Tells how Armcre blocks meet all requirements. Write to Ayer-McCarel-Reagan Clay Co., Brazil, Ind.

Need Low-Cost Air For Sewage Treatment?

602. New booklet on Centrifugal and Rotary Positive Blowers engineered to fit your needs: air for activated sludge; constant vacuum for filters; priming centrifugal pumps; measuring sludge gas; water treatment. Write Roots-Connersville Blower Corp., 712 Poplar Ave., Connersville, Ind.

Biofiltration for Economical Secondary Treatment

605. Biofiltration means lower first cost of filters, control of recirculation rates, less operating personnel, no fly and odor nuisance. Get all details in bulletin PW today from the Jeffrey Mfg. Co., 947-99 No. Fourth St., Columbus 16, Ohio.

WATER WORKS

Hydraulic Pipeline Scraper For Water and Sewage Mains

382. For a copy of this compact folder on a hydraulic pipeline scraper which cleans all kinds of mains from 4 inches to 14 inches write to Dept. PW, Carver-Stimpson Pipe Cleaning Co., Walters, Okla.

Solve Corrosion Problems With This Special Alloy

391. "Everdur Metal" is title of an 8-page illustrated booklet describing advantages of this corrosion-resisting alloy for sewage treatment equipment, reservoir, and waterworks service. Dept. P.W., the American Brass Co., 25 Broadway, N. Y. C.

To Measure, Mix, Feed Chlorine or Other Gases

397. Everson SterElators. Bulletins 1063, 1066, 708 and others describe this device for measuring, mixing and feeding chlorine or other gases in solution. Capacities range from ¼ lb. to 2,000 lb. of gas per 24 hours. Address: Everson Manufacturing Co., 214 W. Huron St., Chicago 10, Ill.

Make Water Extra Safe

399. Safe water may be one of the civic improvements your citizens expect soon. Feeders of all types including Hypochlorinators, Reagent Feeders, Dry Chemical Feeders, Chlorinators and Ammoniators for feeding all of the usual chemicals used in sanitation practice. Ask for latest catalogs. Dept. P.W., Wallace & Tiernan Co., Newark 1, N. J.

Chem-O-Feeders for Automatic Chemical Feeding

400. For chlorinating water supplies, sewage plants, swimming pools and feeding practically any chemical used in sanitation, treatment of water and sewage. Flow of water controls dosage of chemical; reagent feed is immediately adjustable. Starts and stops automatically. Literature from % Proportioneers, Inc. %, 96 Codding St., Providence 1, R. I.

All Types of Valves, Hydrants And Fittings

413. Gate, flap and check valves; floor stands and fittings. New catalog No. 34 gives detail information with dimensions for all types of new full line. M. & H. Valve & Fittings Co., Aniston, Ala.

TO OBTAIN THESE BOOKLETS USE COUPON ON PAGE 77

Complete Data on Gates, Valves, Hydrants

414. Gate Valves. Double disc bronze mounted, sizes 2" to 72", hand, hydraulic, electric or pneumatic operating, rising or non-rising stem. Bulletin X. Address: Rensselaer Valve Co., Troy, N. Y.

What You Should Know About Meter Setting and Testing Equipment

431. The most complete catalog we have seen on setting and testing equipment for water meters—exquisitely printed and illustrated 48-page booklet P.W. you should have a copy of. Ask Ford Meter Box Co., Wabash, Ind.

Do You Have This Data On Cast Iron Pipe?

438. "Cast Iron Pipe and Fittings" is a well illustrated 44 page catalog giving full specifications for their complete line of Sand Spun Centrifugal Pipe, Fire Hydrants, Gate Valves, Special Castings, etc. Will be sent promptly by R. D. Wood Co., Dept. P.W., Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Interesting Facts About Transite Pipe

445. Two new illustrated booklets, "Transite Pressure Pipe" and "Transite Sewer Pipe" deal with methods of cutting costs of installation and maintenance of pipe lines and summarize advantages resulting from use of Transite pipes. Sent promptly by Johns-Manville Corp., Dept. P.W., 22 East 40th St., New York 16, N. Y.

How to Make Better Sewer Pipe Joints

447. How to make a better sewer pipe joint of cement—tight, minimizing root intrusion, better alignment of joint. Permits making joints in water-bearing trenches. General instructions issued by L. A. Weston, Dept. P.W., Adams, Mass.

Need a Water-Tight Pipe Joint?

449. Full information on "Hydro-Tite" jointing compound for bell and spigot pipe, together with specifications, instructions; and illustrations both on it and "Fibrex" sanitary joint packing are contained in handsome 48-page booklet. Address: Hydraulic Development Corp., Dept. P.W., 50 Church St., New York.

Data on High Efficiency Well Water Systems

454. Installation views and sectional scenes on Layne Vertical Centrifugal and Vertical Turbine Pumps fully illustrated and including useful engineering data section. Layne Shutter Screens for Gravel Wall Wells. Write for descriptive booklet P.W., Adv. Dept., Layne & Bowler, Inc., Box 186, Hollywood Station, Memphis 8, Tenn.

Oil or Water Lubricated Turbine Pumps

456. Oil lubricated turbine pumps with open impellers. Five types of heads available. Specifications and illustrations in new bulletin 6930M-2 issued by Fairbanks, Morse & Co., Dept. P.W., 600 So. Michigan Ave., Chicago 5, Ill.

Here's Data on All Kinds of Pumps

458. Performance data and illustrations on all kinds of pumps for all uses. Address: Dept. P.W., American Well Works, Aurora, Ill.

Want Clear, Soft, Iron-Free Water?

467. Water Softening. The use of the Spaulding Precipitator to obtain maximum efficiency and economy in water softening is described in this interesting technical booklet. Permutit Co., Dept. P.W., 330 W. 42nd St., New York 18, N. Y.

Are You Thinking About A Swimming Pool?

472. Data and complete information on swimming pool filters and recirculation plants; also on water filters and filtration equipment. For data, prices, plans, etc., write Roberts Filter Mfg. Co., 640 Columbia Ave., Darby, Pa.

Need Equipment for Small Sewage Plant?

491. Small type Conveyor Sludge Collector and Skimmer, Grit Collector, Aero-Filter and other equipment for small sewage treatment plants are described and illustrated in bulletins from Chain-Belt Co., 1722 West Bruce St., Milwaukee 4, Wis.

Treating Water With Copper Sulphate

496. "Use of copper sulphate in water treatment plants" contains valuable data on chemicals, dosage, etc. Ferri-floc Ferric Sulphate—a new, valuable booklet P.W. on coagulation for water and sewage treatment plants. Write Tennessee Corporation, Atlanta 1, Ga.

Outdoor Water Service Devices That Do Not Freeze

506. Data on anti-freeze outdoor drinking fountains, hydrants, street washers, etc., contained in Catalog L. Sent promptly on request to Murdock Mfg. & Supply Co., 426 Plum St., Cincinnati 2, Ohio.

Find Buried Pipe and Leaks

545. Finding Buried Pipe, Leaks is easy with the new Featherweight Goldak Pipe Locator. An easy-to-read illustrated bulletin tells the full story quickly. Address: The Goldak Co., 1544 W. Glenoaks Blvd., Glenade 1, Calif.

Tired of Digging at Random?

555. There's a better way to locate leaks or "lost" pipe, valves, etc. New literature showing latest models of Pipe Finders, Leak Locators, etc., is offered free by Fisher Research Laboratory Inc., 1961-65 University Ave., Palo Alto, Calif.

Water, Gas, Sewer Pipe Line Equipment

558. Joseph G. Pollard Co., Inc., 145 Ashland Place, Brooklyn, N. Y. Eastern Distributors for the Fisher M-Scope, has issued a catalog No. 24 which describes the mechanisms manufactured by the company for maintenance and construction of pipe lines, melting furnaces and torches, pouring pots, dippers, pails, derricks, tools, joint runners, pipe cutters, hydrant testers, thawers, sewer cleaning machines and similar equipment.

Are You Looking for New Or Reconditioned Valves or Pumps

559. A 16 page bulletin listing all types and makes of new and reconditioned valves and pumps is now available on request from Sonken Galamba Corp., Second and Riverview, Kansas City, Kans.

TO OBTAIN THESE BOOKLETS USE COUPON ON PAGE 77

Jobs for Engineers

Recent college graduate with engineering degree is wanted for sales work with a pipe and foundry company. Write WFP Co., c/o the Editor.

Experienced sanitary engineer for work in Dutch East Indies. Write Mr. Stacey, Medical Div., Standard Oil Co. of New Jersey, Rockefeller Plaza, New York City.

Sanitary engineers are needed by the U. S. Public Health Service, Washington, D. C. Competitive examinations will be held in June for assistant and senior assistant engineers, for the permanent service. For further information write H. R. McCall, Senior Engineer, at the above address.

Ass'n of Military Surgeons

The Metropolitan (N. Y.) Chapter of the Ass'n of Military Surgeons is being reorganized and former sanitary engineer officers are requested to write Gen. C. M. Walson, c/o The Surgeon, HQ. 1st Army, Governors Island, N. Y.

Personal Items

C. N. Harrub Engineering Co., Inc., has moved its offices to 148-B 4th Ave., North, Nashville, Tenn.

Sol Pincus, formerly sanitary engineer with the U. S. Public Health Service and more recently Deputy Commissioner and Senior Sanitary Engineer with the New York City Department of Health, has opened an office at 11 Park Place, New York 7, N. Y., for the practice of sanitary engineering, Public Health Investigations and reports.

Ralph E. Tarbett Dies

Ralph E. Tarbett, Sanitary Engineer Director (Ret.) U. S. Public Health Service, died at the U. S. Marine Hospital, Baltimore, Maryand, January 23. Following graduation from the Massachusetts Institute of Technology in 1905 with B. S. in Sanitary Engineering, probably among the first to be awarded, Mr. Tarbett spent two years as instructor in biological chemistry at Worcester Polytechnic Institute, and from 1907 to 1912 was associated with Robert Spurr Weston, consulting engineer.

In 1913 Mr. Tarbett began his 34-year career with the United States Public Health Service when he was appointed the first sanitary engineer of the Service. In 1928, Mr. Tarbett was assigned as chief of the Sanitation Section, supervising the environmental sanitation activities of the Service throughout the country. From 1941 until its ending in 1944 Mr. Tarbett was chief sanitary engineer of the Office of Civilian Defense. In 1945, Mr. Tarbett served as the Sanitary Engineer officer on the Public Health Service board sent to Japan to study and report upon the medical and public health aspects of the strategic bombing of Japanese cities.

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